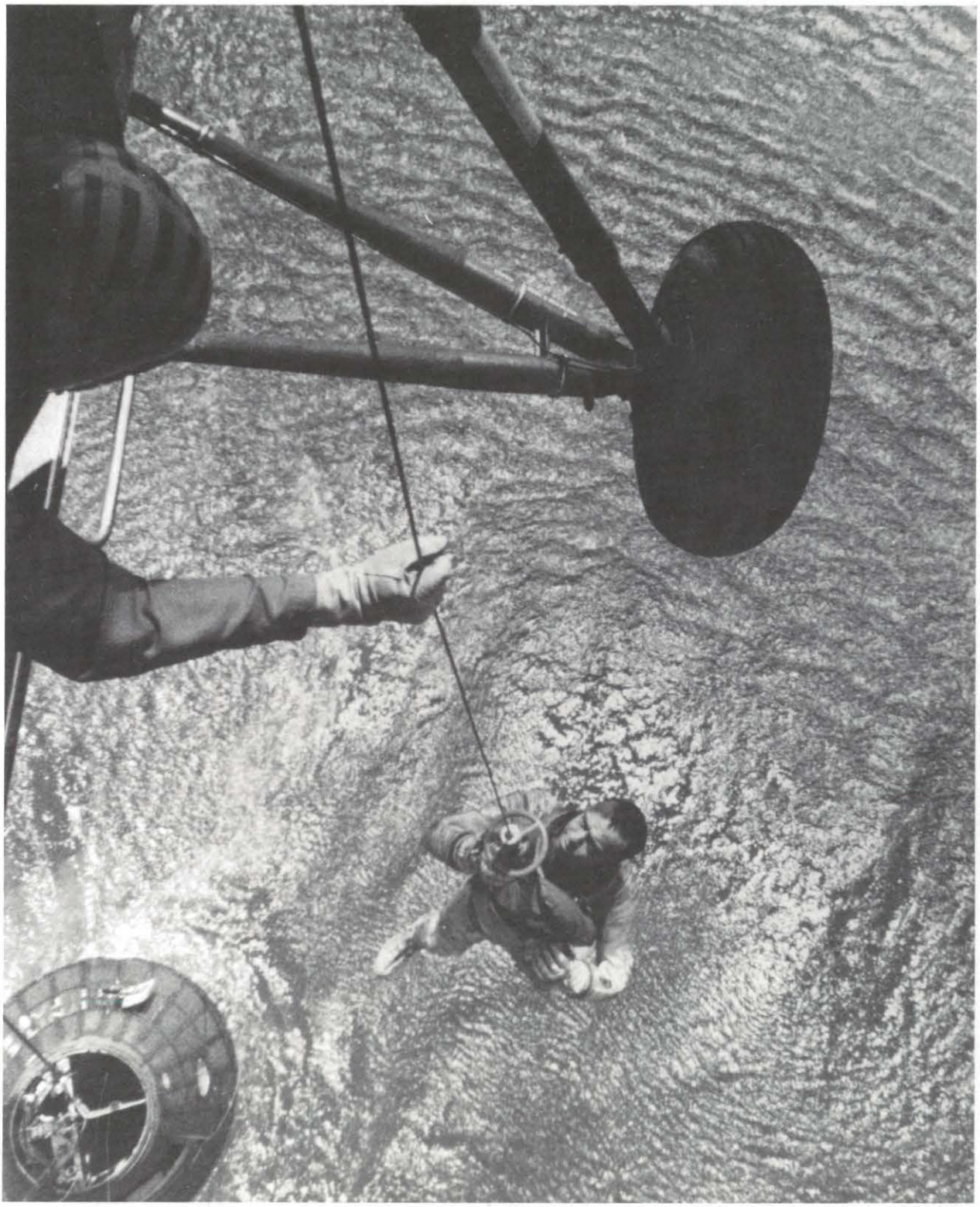
NAVY MEDICINE

May-June 1996



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COVER: Thirty-five years ago, LCDR Alan B. Shepard, Jr., became the first American in space. The story of Project Mercury and an interview with the physician who first examined Astronaut Shepard following his return to Earth appears on pages 5 and 12. NASA photo courtesy of RADM Robert Laning, MC (Ret.).

Navy Crisis Response Team Responds to the Needs of the Coast Guard

Within 6 minutes after take off from the Dominican Republic, a 757 with 176 tourists and 13 crewmembers returning to Germany after a tropical vacation plummeted into the Caribbean Sea. Rumors abounded about the cause of the crash, but one thing was certain, shortly after impact all 189 people were dead. Three helicopters from the Coast Guard and Navy were quickly dispatched to the crash site to look for survivors. Three Coast Guard cutters steamed to the location as well in hopes of rescue. Unfortunately, on 6 Feb 1996, no survivors were found.

From the initial appraisal of the gruesome task of picking up mangled body parts and personal effects it was obvious that the 150 members involved in the operation would need assistance in coping with the psychological effects of trauma. The Coast Guard Work/Life department dispatched members from around the country and called upon the expertise of a civilian and Navy psychologist to lead debriefing groups for the rescuers. The newly formed Crisis Response Team (CRT) of Naval Hospital Roosevelt Roads, Puerto Rico, consisting of two corpsmen and the psychologists, worked closely with a Coast Guard chaplain and members trained in critical incident stress debriefing (CISD).

The Navy has long recognized the devastating effects of trauma on its members. Various modalities have been implemented to help its members cope with the ravages of war.(*1*) In 1977 a Special Psychiatric Rapid Intervention Team (SPRINT) was formed at Naval Hospital Portsmouth, VA, to respond quickly to mishaps and natural disasters around the globe. At present there are three SPRINT teams located at Bethesda, MD; Portsmouth, VA; and San Diego, CA.(*2*) There has been a recent development of mini-SPRINT teams at numerous commands outside the continental United States.(*3*) After receiving SPRINT training at Bethesda, LT Andy Davidson organized a CRT team at Roosevelt Roads Naval Base comprised of similarly trained professionals. The naval base is the hub for Caribbean exercises comprised of special operations, a dive command, and active port and air operations, as well as a fixed air wing squadron. With so much activity, the potential for mishaps as well as natural disasters was apparent. Within 1 week of formation, the team was involved in the largest air disaster in Coast Guard history.

On the morning of 9 Feb, the team met with Coast Guard command staff in San Juan, Puerto Rico, who briefed them on the magnitude of the disaster. It was

reported that three Coast Guard cutters, the USCG *Knight Island,* USCG *Jefferson Island,* and USCG *Spencer,* responded to the scene and began retrieving bodies on 7 Feb. The crews worked until dark when they returned to port to unload the body bags. They returned to the crash site the following day to retrieve debris from the airplane. While many members of the boats were experienced in picking up drowning victims, no one was prepared to deal with the onslaught of human carnage that resulted from the horrific impact. Bodies were cut in half from seat belts, limbs were torn from their sockets, while splintered bones and skin floated amidst luggage, wallets, and other personal effects. Snack trays were recovered that had imprints of faces and teeth testifying to the impact of the crash.

Membership of the debriefing groups ranged from 6 to 20 members of various ranks. The groups followed a protocol of preparation, fact, thought, feeling, signs and symptoms, teaching, and reentry.(*4*) It was anticipated that having command staff with enlisted members may inhibit disclosure; however, leadership actually facilitated participation through positive modeling. The groups began with an introducing of the leader who emphasized the confidentiality and that the groups were in no way part of an official investigation. In the fact stage the members described what actually happened for the past 2 days. Members wanted to jump from topic to topic but were gently guided through a chronological account of the past 3 days. They described working long hours recovering body parts. Not one body was intact. They retrieved limbs, broken bones, skin, and internal organs from the sea. The rescuers contended with aggressive sharks, the hot sun, and an insufferable stench that permeated the ship. One cutter's deck was completely covered with bodies. The body handlers were often splashed with fluids as body parts deteriorated before their eyes.

Each member had a particular vivid recollection about one scene. For some it was the expression of horror on a face that seemed to be frozen at the point of impact. For others it was the sight of a youthful body that was missing a face. And for some it was the sight of a child floating next to the outstretched arm of what may have been her father. One recalled seeing two adults floating side by side and supposed they must have been married. Unlike previous air disasters, some members had more trouble dealing with the personal effects than the bodies because the bodies did not seem real, but the personal effects forced them to deal with the humanity of the corpses.(*5*) For many, their most vivid memory was their first glimpse of a dead body. Most attempted to avoid looking at faces, such a practice common among body handlers.(*4*) However, several members reported that because the bodies were so badly mangled they actually hoped to see one intact face.

The Coast Guarders attempted to distract their thoughts by thinking of their loved ones at home. They filled their time by attempting to reconstruct the crash and proposed various theories about why the crash occurred and what the people were doing prior to impact. They attempted to joke about the situation as their humor provided with occasional relief from the overwhelming task. Gallows humor is a common defense for body handlers as it allows them to safely detach themselves from the moment.(*6*) One topic that no one joked about was children. One boat made a pact that they would not even mention the word "child."

The groups' initial emotion was that of denial followed by anger and then depression. They remarked about their tendency to avoid and depersonalize the situation. They experienced flashbacks, dreams, and recurrent thoughts. They often reported that as soon as they turned out the lights at night they saw their first sight of that day. They were rather somber at first and experienced a sense of numbness and derealization. They were angry about how some civilians handled the bodies after their humane treatment. They were also angry about intrusions of the media who seemed intent on filming the gory details of the disaster. Most were able to sleep and eat adequately despite feeling tired and an initial loss of appetite. They described how they came together as a

group and protected the bodies that they retrieved. Throughout the operation they were very concerned about their families.

As the groups progressed, the predominate emotions shifted from denial to mild feelings of depression. Members expressed remorse, lethargy, and anger. The final groups were the most emotionally charged and often wept openly. Additionally, officers expressed guilt for ordering men to perform objectionable tasks. However, all the men reported that they did not feel forced to handle the bodies. On the contrary, once they began their work, it was difficult to persuade them to take breaks until the operation was completed.

After the feeling phase, a shift was made to provide some education about various signs of acute stress. Members were then given educational material provided by the Coast Guard as well as suggestions of ways to deal with their experience. They were encouraged to continue to talk with each other, the Work/Life staff, and the chaplain. After returning to port, followup was encouraged as well. To deal with reentry various recommendations were provided to the command that included liberty, a memorial service, and continued staffing from the commanding officers. The groups were concluded with the reaffirmation of their heroic efforts amidst a surrealistic experience. The rescuers were thanked for their humane treatment of the bodies that exemplified the sanctity of human life.

In the course of 2 days approximately 160 Coast Guard and Navy members participated in 1 of 12 groups. The PIE acronym of proximity, immediacy, and expectancy was a key component in treating these rescuers.(*7*) The overall objective was to see members close to the scene soon after the disaster, and provide an expectancy that their feelings were a normal reaction to a very abnormal situation.

By exploring what they saw, thought, and felt, the members were able to begin to recover from the trauma they experienced. The effect of this intervention was to allow the cutters to return to a safe level of operation. Research has indicated that in similar air disasters, when this type of intervention is not implemented, the results can be an increase of 30 percent in the incidence of post-traumatic stress disorder (PTSD). With intervention, the incidence of PTSD can be as little as 1 percent.(*4*) It is anticipated that the immediate intervention of the teams significantly reduced the loss of manpower and resources.

The establishment of SPRINT, CRT, and CISD teams in the Navy and Coast Guard has contributed significantly to the reduction of serious psychiatric disorders.(*3*) As more teams are formed on Navy bases throughout the world, it is expected that more servicemembers will be afforded proximal, immediate, and professional care. While this experience on the CRT team members took its toll initially, their effort was rewarded by seeing young men and women deal successfully with their own mortality in the face of tragedy.

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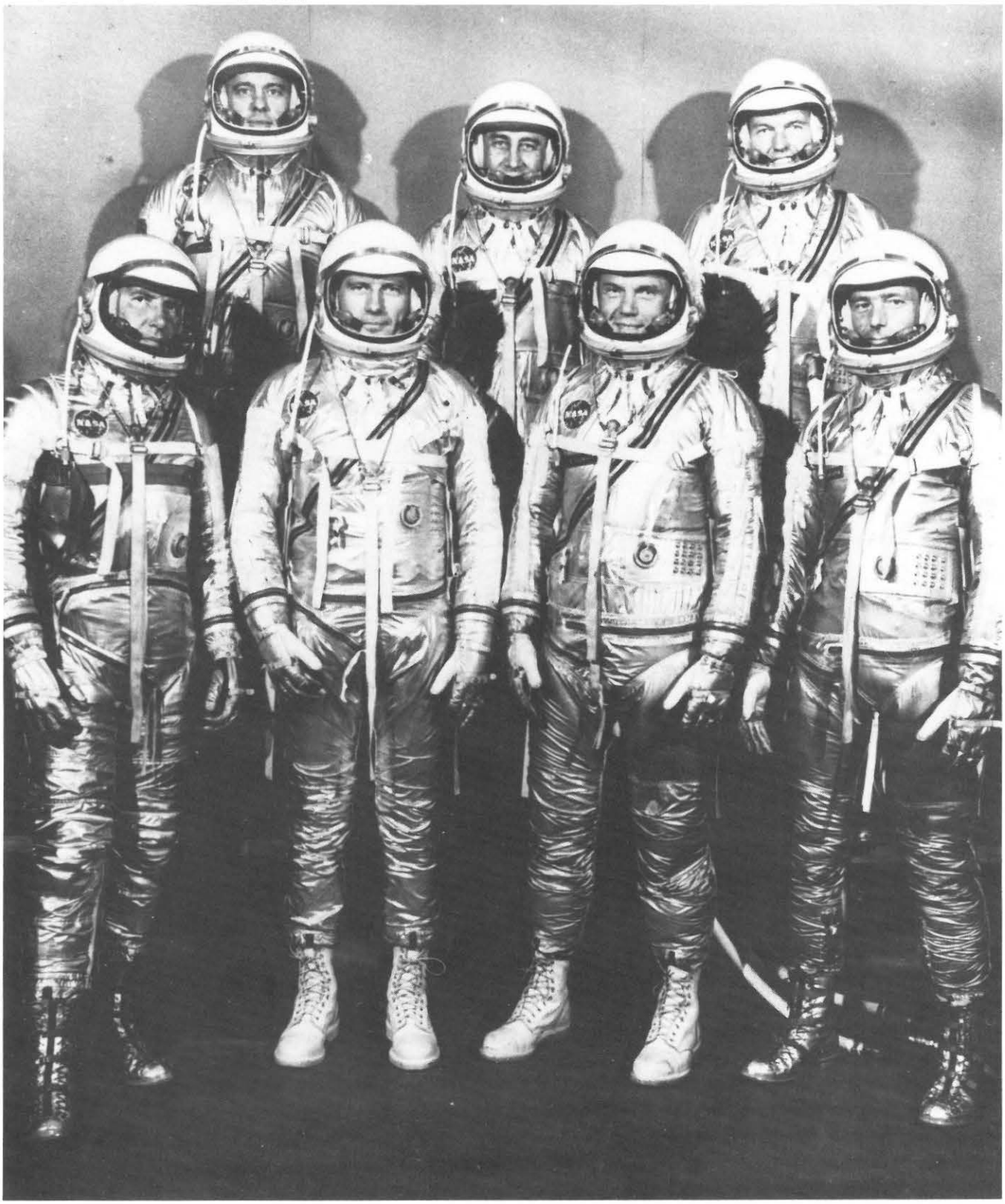
NASA photos courtesy RADM Robert Laning, MC (Ret.)



The Project Mercury Astronauts. Front row (left to right): Walter M. "Wally" Schirra, Jr., Donald K. "Deke" Slayton, John H. Glenn, Jr., and M. Scott Carpenter. Back row (left to right): Alan B. Shepard, Jr., Virgil I. "Gus" Grissom, and L. Gordon Cooper, Jr.

Project Mercury:
A 35th Anniversary

On 4 Oct 1957 Americans awoke to the news that above them a Soviet satellite—*Sputnik*—was circling the Earth. A radio announcer commented on the significance of the "beep-beep" radio signal emanating from the 184-pound steel sphere: "Until two days ago, that sound has never been heard on this Earth. Suddenly it has become as much a part of twentieth-century life as the whir of your vacuum cleaner...The satellite is still maintaining a speed of 18,000 miles an hour, a dozen times faster than any man has ever flown."*(1)*

This homey vacuum cleaner analogy failed to quench the sudden panic that gripped America in the days that followed. How had the world's most powerful nation fallen so behind its communist nemesis?

American education was to blame. Math and science were being taught improperly or not at all. Perhaps the free enterprise system was in decline. The nation's very security was in doubt. If the Soviets could orbit a satellite, weren't their powerful boosters equally capable of lobbing nuclear warheads onto New York, Washington, or Los Angeles?

Space Race

Two themes subsequently became intertwined: the space race, which, up until *Sputnik*, had not been a race at all, and the security of the United States. National prestige depended upon the outcome of the first concern; national survival the second. In fact, one of the themes of the 1960 presidential campaign was the perceived "missile gap." The Soviet Union, it was said, was far ahead of the United States both in the power of its rocket engines and the number of nuclear-tipped missiles in its arsenal. (Data later indicated that the so-called missile gap never really existed.)

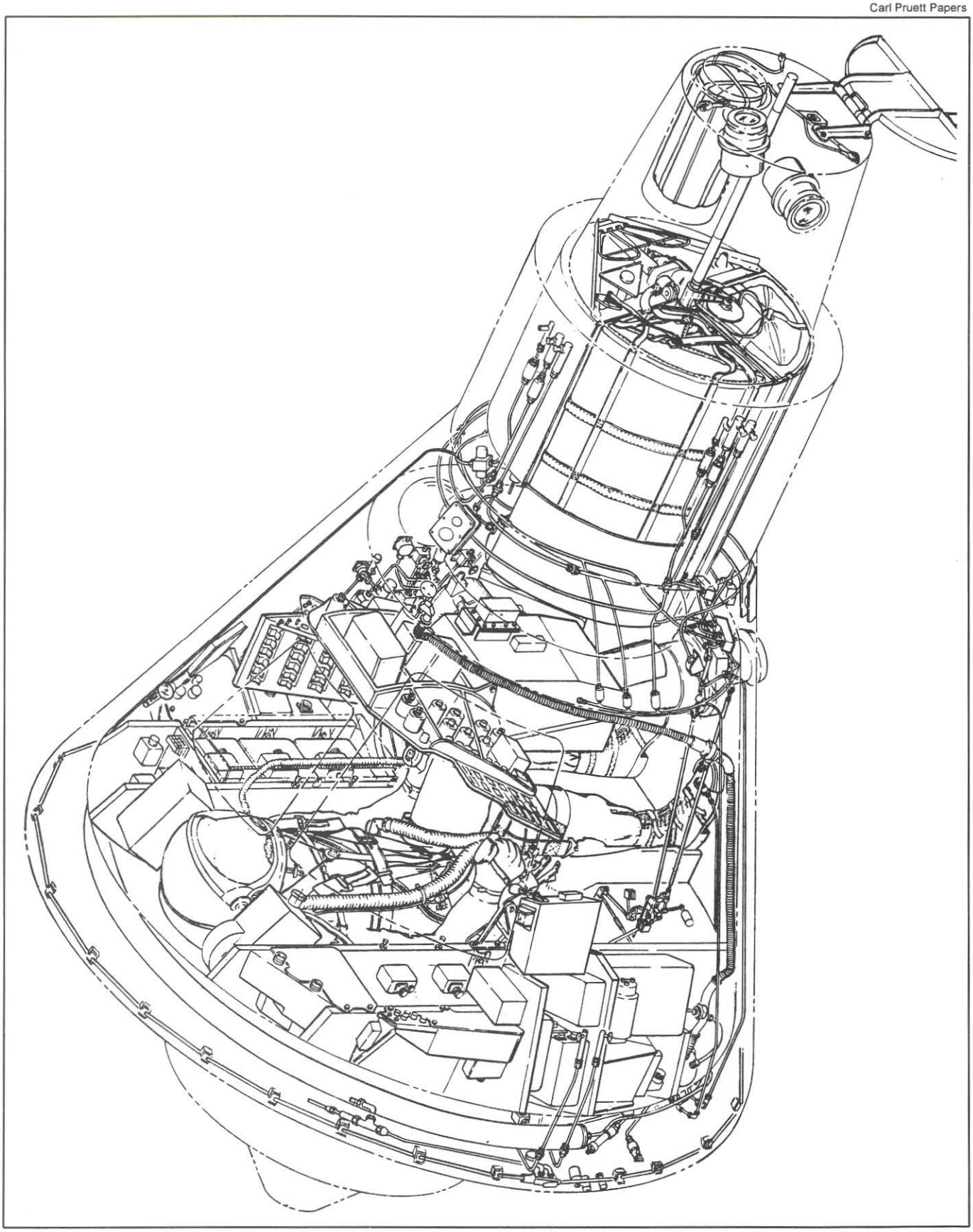
After much recrimination and hand-wringing, the national leadership addressed the fact that if there had not been a space race, such a contest had now been thrust upon us. The United States could not afford to come in second to its nuclear competitor.

Sputnik had not initiated the beginning of America's space program. Missile development and high-altitude research began right after World War II with captured German scientists and the unused V-2 rockets they brought with them to the West. *Sputnik* had merely speeded things up.

But even as new space goals were set, the Soviets were not resting on recent successes. Barely a month after launching *Sputnik*, scientists and engineers again demonstrated their superiority by launching another satellite, this time with a canine passenger—Laika. The United States responded with an attempted launch of an experimental satellite—*Vanguard*—on 6 Dec 1957. The 3-pound "grapefruit," the United States' scientific contribution to the International Geophysical Year (IGY), was supposed to orbit the Earth carrying temperature probes and two radio transmitters. With the world watching, the pencil-like rocket lifted but 4 feet before toppling to the ground and exploding.

A month after the *Vanguard* fiasco, a modified Army Jupiter missile successfully placed *Explorer I* in orbit, finally making the United States a full-fledged space contender.

The Soviets, however, continued to shock and amaze. On 12 April 1961 Yuri Gagarin became the first human to travel in space when he made a single orbit of the Earth. The USSR had raised both the stakes and level of the competition.



Mercury capsule interior

Even before Gagarin, Americans had flown to the edge of space in high-altitude aircraft and slung beneath balloons. But *near* space and *in* space were quite different. Sending humans into a space environment and returning them safely would be difficult and very expensive.

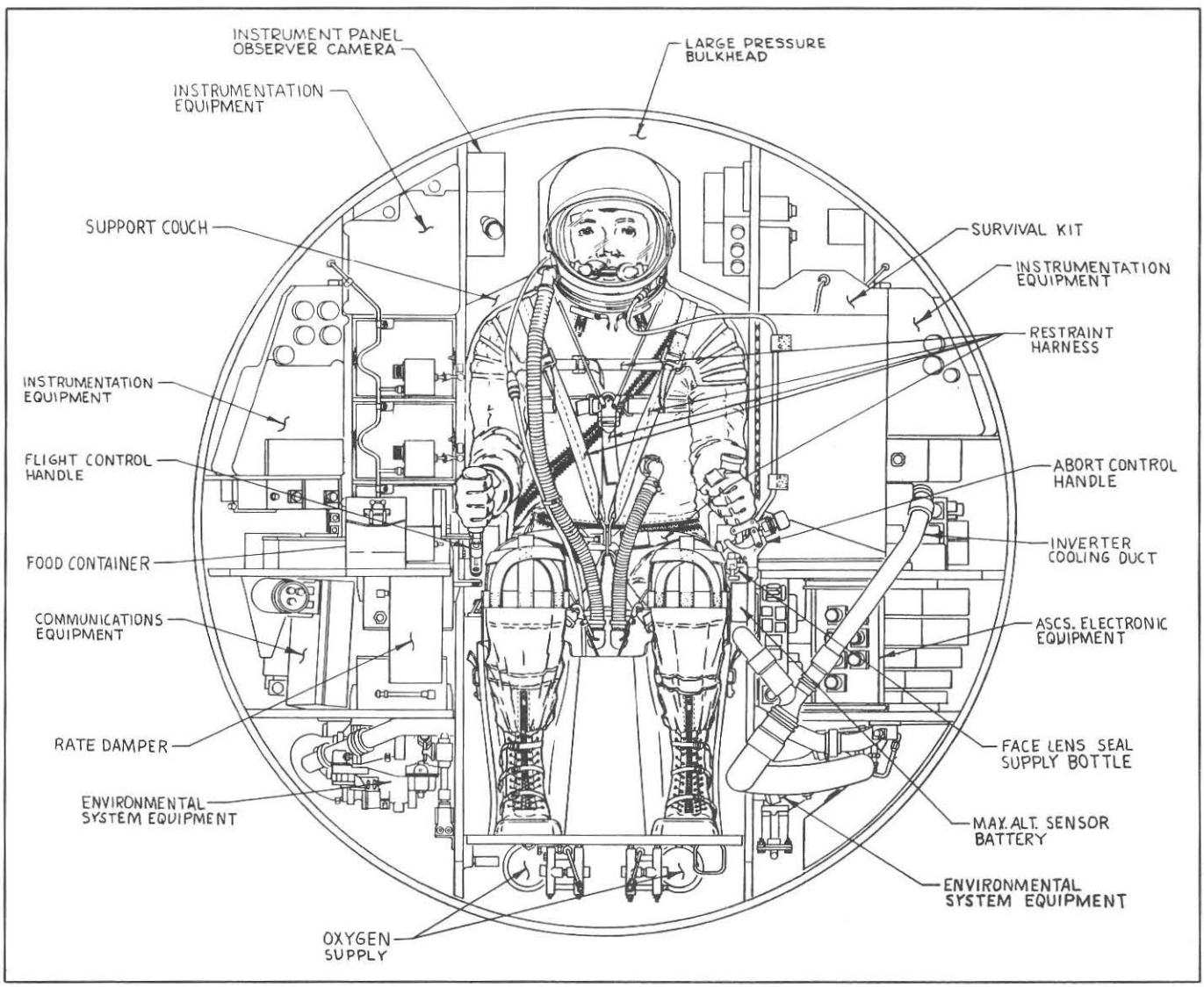
Because President Eisenhower felt strongly that space exploration should be a civilian enterprise, the mission fell to the newly created National Aeronautics and Space Administration (NASA) in 1958. Nevertheless, the military would play a key role in providing rocket boosters early on, and the military medical establishments of the three services would provide their resources and expertise.

NASA's primary mission was to put Americans in space—Project Mercury. Its scientists and engineers were charged with achieving that goal, providing an environment in which humans could perform effectively, and recovering them safely. The flights would be limited by the capability of available launch vehicles, and a newly developed space capsule that was rudimentary and very confining.

The effects of prolonged weightlessness on the human body and the ability to function in such an environment would have to wait for future space flights. In this preliminary phase of manned space flight, putting a man in orbit and having him operate effectively in that environment seemed ambitious enough. Manned lunar exploration would come later. Manned expeditions to the planets would come later still.

Astronaut Selection

Who would be the first astronauts?



Carl Pruett Papers

Crammed with equipment, the Mercury capsule layout left little room for the astronaut.

Alan Shepard in spacecraft just prior to launch

President Eisenhower himself decided that they would come from the experienced pool of military test pilots. There were seven basic criteria:

(1) Less than 40 years old
(2) Less than 5'11" in height
(3) Excellent physical condition
(4) Bachelor's degree or equivalent
(5) Graduate of test pilot school
(6) 1500 hours total flying time
(7) Qualified as jet pilot*(2)*

From a total of 508 service records screened, 110 men met these minimum standards. This list included 5 Marine, 47 Navy, and 58 Air Force pilots. There were no Army pilots who had graduated a test pilot school.*(3)*

By the beginning of March 1959, the list had been further reduced to 36 men. Of these, 32 accepted an invitation to undergo the most physically and psychologically demanding tests yet devised. Chaired by a senior management engineer, the selection committee included a test pilot engineer, two flight surgeons, two psychologists, and two psychiatrists. The committee considered not only their physical and psychological abilities but also their technical training and flight experience.

The evaluation would be in two parts. Following a week of extraordinary physical examinations at the Lovelace Clinic in Albuquerque, NM, they were then to undergo extreme mental and physical environmental tests at the Aeromedical Laboratory of the Wright Air Development Center, in Dayton, OH.*(4)*

The examiners at the Lovelace Clinic first sought information about the pilot's total flying hours in various aircraft, including details of combat missions, accidents, bailouts, use of the ejection seat, explosive decompressions, and altitude indoctrination and operational experience with partial or full-pressure suits.*(5)*

The medical history included a conventional medical history together with a family history; the attitude of the immediate family toward hazardous flying; the subject's growth, development, and education; recent travels to areas where parasitic diseases were endemic; any disorders precluding pressure inflation of the ears, sinuses, or lungs.*(6)*

The eye examination included refraction, visual fields, extraocular muscle balance, red lens test, tonometry, depth perception, slit lamp, dark adaptation, and dynamic visual acuity. There was also color photography of the conjunctival and retinal vessels.*(7)* The otolaryngological tests consisted of visual inspection, indirect laryngoscopy and nasopharyngoscopy, audiometric thresholds, speech discrimination, and labyrinth function by the standard caloric method. *(8)*

Each candidate underwent a thorough cardiological exam including electrocardiograms and ballistocardiograms. The neurological exam tested the reflexes and coordination, ascertained the normalcy of cerebellar function, and determined proprioception and other senses. There was also an electroencephalogram, including a determination of the effects of hyperventilation.*(9)*

Where indicated, specialists performed additional examinations. A surgeon performed proctosigmoidoscopy.

There were lab tests: complete blood count and special hematology smear, hemoglobin, hematocrit, sedimentation rate, fasting blood sugar, cholesterol, blood grouping, sodium, potassium, carbon dioxide, chloride, urea clearance in blood and urine, blood urea nitrogen, catecholamine, protein-bound iodine, protein electrophoresis, blood volume, total body water determination, throat cultures, stool examination, and sperm count. *(10)*

The radiological examination included: X-rays of teeth, sinuses, thorax posteriorly-anteriorly in inspiration and expiration, the esophagus, stomach, colon, and lumbosacral spine. Not leaving anything else to chance, technicians made cineradiograms of the candidates' hearts looking for any preclinical evidence of arteriosclerosis.*(11)*

And then the physicians really got serious. They tested the men's physical competence tests on a bicycle ergometer with measurement of heart rate, blood pressure, respiratory volume, and respiratory gas exchange. They determined body density by weighing the nude body in water.

The final evaluation sought to determine each candidate in terms of his physical, mental, and social well-being. The men were such healthy specimens that only 1 of the 32 candidates had a medical problem serious enough to merit disqualification.

Following successful completion of the Lovelace phase, the candidates

Shepard stands beside *Freedom 7* capsule aboard USS *Lake Champlain* following his history-making flight.

went on to the Air Force Research and Development Command at Wright-Patterson Air Force Base in Dayton, OH. While the Lovelace tests had been to determine the general health of the candidates, these tests were designed to determine the physical and psychological capability of each candidate to respond effectively and appropriately to the types of stresses associated with space missions.*(12)* They would include tests employing acceleration, vibration, heat, and loud noises. That week there would also be continuous psychiatric interviews, the necessity of living with two psychologists, an extensive self-examination through a battery of 13 psychological tests for personality and motivation, and another 12 tests on intellectual functions and special aptitudes.*(13)* Specific tests included:

(1) Harvard step test

(2) Treadmill maximum workload

(3) Cold pressor—subject plunges feet into tub of ice water. Pulse and blood pressure measured before and during test

(4) Complex behavior simulator

(5) Tilt table

(6) Partial pressure suit

(7) Isolation

(8) Acceleration

(9) Heat

(10) Equilibrium and vibration

(11) Noise*(14)*

After correlating clinical and statistical information from New Mexico and Ohio, 18 of the 31 candidates came recommended without medical reservations for final consideration.

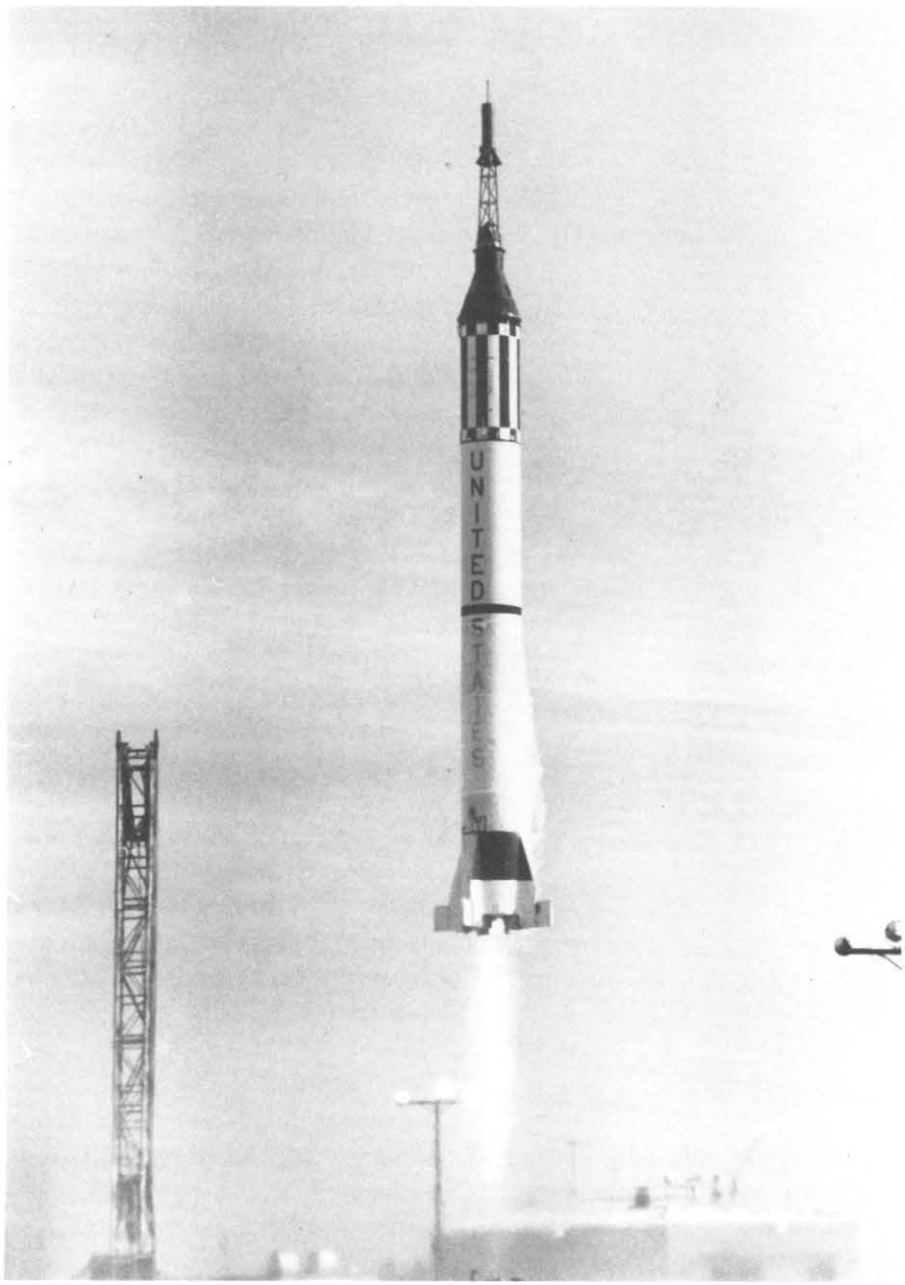
On 2 April 1959 NASA announced the names of the seven finalists who could then call themselves Mercury astronauts:

LT Malcolm S. Carpenter, USN; CAPT Leroy G. Cooper, Jr., USAF; LCOL John H. Glenn, Jr., USMC; CAPT Virgil I. Grissom, USAF; LCDR Walter M. Schirra, Jr., USN; LCDR Alan B. Shepard, Jr., USN; and CAPT Donald K. Slayton, USAF. The final Lovelace Report stated the obvious: "The seven...were selected because of their exceptional resistance to mental, physical, and psychological stresses, and because of the particular scientific discipline or specialty each presented... Their average age was 34.1, with ages ranging from 32 to 37...."*(15)*

The Capsule

Even as these men were being poked, probed, pierced, chilled, baked, pressurized, and questionnaired almost to death, engineers were putting the finishing touches on the Mercury capsule they would ride into space. The overall length of the spacecraft was but 9 1/2 feet with a total volume of only 40 cubic feet. Encased in his pressure suit and crisscrossed by straps and hoses, the astronaut had a range of motion measurable only in inches.

Remote monitoring of the astronaut's physical status during flight was of paramount importance and would be accomplished through telemetry to ground stations, where flight surgeons could evaluate the situation as the capsule passed overhead.



A Mercury Redstone rocket lifts off from Cape Canaveral 21 July 1961 carrying astronaut Virgil I. "Gus" Grissom on the second manned space flight.

These "medical monitors" were Navy and Air Force personnel on loan to NASA.

Sensors attached to the astronaut's body monitored heart rate, respiration, body temperature, and blood pressure. The latter was measured using an inflatable arm cuff, while a helmet-mounted thermistor enabled the monitoring of the astronaut's respiration rate. Body temperature was taken via a rectal probe.

Flight

Following exhaustive training by the astronauts and a suborbital flight by Ham, a 37-pound chimpanzee, LCDR Alan B. Shepard, Jr., blasted off on 5 May 1961 for a 15-minute suborbital flight of his own. After capsule separation from the Redstone booster, Shepard took over the controls and successfully maneuvered the capsule in pitch, yaw, and roll. He reached a speed of 5,146 mph and an altitude of 116 miles before splashing down in the Atlantic 303 miles southeast of Cape Canaveral. Following his retrieval from the ocean and transfer to the prime recovery ship, USS *Lake Champlain* (CV-39), the medical team sought to determine what shape he was in after his brief space ride. There had been some apprehension as to how he would be affected by the high acceleration load of launch, weightlessness, and the rapid deceleration of reentry. Some physiologists had feared that even a few minutes of weightlessness could cause disorientation, while some psychologists were equally apprehensive about what would happen to a space passenger's mind.*(16)* But the physicians found Shepard to have suffered no ill effects (see Interview). In fact, he reported the whole experience as quite pleasant.

CAPT Virgil I. Grissom followed Shepard with his suborbital flight of 21 July 1961. Although the flight was very similar to his colleague's until splashdown, Grissom's recovery was anything but routine. The hatch prematurely blew requiring him to abandon the capsule as water poured in. Almost immediately, his space suit began filling with water dragging him under. As attempts to retrieve the sinking capsule failed, Grissom himself came close to drowning before being pulled to safety. Although the loss of *Liberty Bell 7* marred a near perfect flight, the mission was nevertheless judged a success. It was only left to John Glenn to orbit the Earth.

On 20 Feb 1962 an Atlas rocket propelled LCOL John H. Glenn, Jr., into orbit. Riding his Mercury capsule, *Friendship 7*, three times around the earth, Glenn provided some un-

Photo courtesy Jean Pruett

For John Glenn's orbital flight, medical monitor CAPT Carl Pruett, MC (left rear), and astronaut Walter M. "Wally" Schirra (third from left center), help man the Mercury control station at the U.S. Naval Missile Facility, Point Arguello, CA.

planned suspense. A faulty indicator showed that his heat shield had become dislodged, a life-threatening situation that could have incinerated him upon reentry. Ground controllers decided not to jettison the retrorocket package as planned, hoping the straps that held it in place would also stabilize the possibly errant heat shield.

The reentry was anything but routine as flaming chunks of the retrorocket package flashed by his window. "That was a real fireball!," Glenn exclaimed. But the heat shield held and Glenn splashed down uneventfully in the Atlantic about 40 miles short of the predicted area. The USS *Noa* (DD-841) winched him aboard 17 minutes later, still in his capsule. He then told the ship's crew to stand clear, and hit the hatch detonator plunger with the back of his hand. The plunger recoiled, cutting his knuckles slightly through his gloves, thus inflicting the only injury he received during the mission.*(17)*

LCDR Robert Mulin and Army physician CAPT Gene McIver conducted a preliminary examination aboard *Noa*. They described Glenn as being hot, sweating profusely, fatigued, lucid but not talkative. Following a glass of water and a shower, he became more loquacious. He admitted only to some "stomach awareness," beginning after he was down on the water but had experienced no nausea or stomach unease during the flight. Due to dehydration, he had lost 5 pounds, 5 ounces from his preflight weight of 171 pounds, 7 ounces. An hour after landing his temperature was 99.2 degrees, only a degree higher than his preflight reading. By midnight he recorded a normal temperature. His blood pressure registered only a fraction higher than the preflight readings. His heart and lungs were normal.*(18)* During the flight, Glenn ate the equivalent of only 94 cubic centimeters of water (applesauce puree) for the rather long period of almost 13 hours from breakfast at 2:50 a.m. EST to shipboard at 3:45 p.m. EST. During the flight, he also ate one 5 gram sugar tablet (xylose).*(19)* Following a general physical examination conducted later at Grand Turk Island, physicians found few measured differences between the preflight and postflight medical findings. Space did not seem as inhospitable an environment as first thought.

Three more Mercury orbital flights followed. The last, by Gordon Cooper, was a 22-orbit, 34 hour and 19 minute mission. The nation was ecstatic with relief and pride. Six Mercury astronauts flew in space from 1961 to 1963, logging a total of 2 days and 6 hours. They had made it a real race again, with the finish line now the Moon.—JKH

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Recollections of Project Mercury

In 1961 then CDR Robert Laning, MC, was assigned to Project Mercury as the senior member of the prime recovery team for the flights of Alan Shepard, Virgil Grissom, and John Glenn. Navy Medicine *recently spoke with RADM Laning, now retired, about his recollections of the first Americans in space.*

Your first mission was for the 1961 Shepard suborbital flight.

Yes. I was the senior member of the prime recovery team which consisted of HM3 Johnny Barnes, an OR tech from our hospital, Philadelphia, and an Army anesthesiologist, Dr. Jerry Strong. We were to be aboard the *Lake Champlain* for the first spaceshot.

What were your duties on the recovery team?

They chose surgical teams because they didn't know whether the astronauts would be injured or not, but they decided it was very important to be prepared to take care of possible injuries. All the teams therefore were surgical teams consisting of a surgeon, an anesthesiologist, and an OR tech. There were complete OR setups with instrument trays, everything. About a ton of gear went aboard.

How many ships would they deploy?

For the orbital shots, I recall there were something like 12 or 15 ships each with a surgical team from all the services—Army, Navy, and Air Force. We were all TAD (Temporary Additional Duty) for the orbital shots.

What do you remember about that first flight of Alan Shepard?

The day before, it suddenly occurred to me that if this guy were injured, I would have to notify the Cape in a hurry on an open airway and I didn't think that was very wise. So I devised a rather simple code that I could use on a ship-to-shore telephone.

A-1 means "He's OK he's fine and I don't need any help." And the code went all the way down to something like D-E, which meant "He's dead and I need a pathologist." The injury would be described by the letter—A, B, C, D, E, F, G and whether I needed help with a 1, 2, 3, or 4. And they were prepared to send consultants out to the ship if I needed them. I had to encode this message and send it to the Cape to get their permission to use it ahead of time. I was concerned because 1 hour prior to the flight (the next day) we still didn't have permission to use this code. But finally it came.

Had you devised this code pretty much on the spot?

That's right. No one had thought of it.

How did you encode it?

That was the difficulty because Cape Canaveral was an Air Force base and they didn't have decoding equipment for Navy. What they had to do was send it to a Navy facility to be decoded. When they finally gave us permission to use it, they didn't encode the reply because all they had to say was, "Your plan is approved."I should also mention that prior to each of these flights we had to have blood available. We had walking donors. On the way out we would call people with the same blood type as the astronauts. On the first one, we drew blood and had several pints available in the refrigerator. And then we had a walking donor system whereby other people with the same type were available.

What about the morning of the actual flight?

I was up on the flag bridge waiting. We knew about where to look for the

parachute and indeed we found it and followed it coming all the way down. We were about 3 miles away. A helicopter went out to pick up the astronaut and the capsule had to be recovered. We were all in civilian clothes. That was a political move. Apparently, one European country NASA was dealing with to build tracking stations accused the United States that our space program was military, not peaceful.

Was that Portugal?

Yes. The deal was that whatever people were immediately concerned with the astronaut and the capsule would be in civilian clothes and this is what any photographs that were taken would show. So our surgical team was in civilian clothes. As a result of this, our corpsman who was bunking down with the enlisted, had some trouble. They knew he was an HM3 but he was aboard ship in civilian clothes. That just didn't happen. However, I had no problem in the wardroom nor did Dr. Strong.

Had you met the astronauts prior to that time?

No. Shepard didn't know who we were when he came aboard. When I put out my hand to help him out of the helicopter, he gave me a funny look. "Who are you?" I said, "I'm Dr. Laning. I'm part of the recovery team." He said, "I didn't expect you." It seems he thought we might be newsmen and he had been instructed not to talk to newsmen until after his debriefing and his physical.

For the physical, we used the admiral's cabin one deck below the flight deck because it was the most accessible. Everyone, including the admiral, knew they couldn't get to the astronaut until we had finished his debriefing and physical exam. We had completed his physical, taken his

The prime recovery team (medical) aboard USS *Lake Champlain* await the arrival of astronaut Alan B. Shepard, Jr. (left to right): HM3 Johnny Barnes, MAJ Jerome Strong, MC, USA, and CDR Robert Laning, MC.

blood and urine and sent it down to sick bay. Shepard was then sitting at the admiral's desk talking into a tape recorder debriefing himself. He had some written questions he had to answer. And in the middle of all this the admiral burst in and said, "The President is on the phone and wants to talk to him." Suddenly we realized that Shepard had no clothes but for his flight suit and we had already taken that off. So the admiral had to give Shepard his own flight suit so he could go up to the flag bridge to talk to the President. He then went back to the admiral's cabin and continued with the debriefing.

Was the debriefing all into a tape recorder or were you asking him questions?

He was responding to the questions in the booklet. I asked the original questions concerning medical matters such as how do you feel and that sort of thing.

How long did the debriefing take?

The whole thing, including the physical, took about 2 hours.

Doctors Jerome Strong (right front) and Robert Laning help Shepard out of his pressure suit.

Was it a complete physical?

It was as complete as it could be without X-rays, including a neurological examination. Of course, we had those facilities available in sick bay. If he had been injured, we would have determined that when he got off the helicopter. If he had been injured, we were to take him directly to sick bay, not to the admiral's cabin.

When we were finished, I turned him over to the captain and the admiral and I think they took him down to the crew's mess. Then it was time to go to Grand Bahama Island. They wanted to catapult him off the ship but I made the decision to deck launch the airplane that would take him to Grand Bahama Island. I thought he had had enough g's and a deck launch seemed safer. Not being an aviator myself or a flight surgeon, my decision didn't go over very big. In those days, we had no direct communication with the Cape. Motion picture film and photos had to be sent by aircraft and none of that could happen until the deck was cleared after we left.

Did you go with him?

Yes, my whole team, including

NASA photos courtesy RADM Robert Laning, MC (Ret.)

Right: As water fills Grissom's *Liberty Bell 7* spacecraft, the weight is too much for the Marine helicopter, whose wheels now touch the water. Moments later, the pilot released the capsule and it sank in 2800 fathoms of water. Below: Happy to be alive following his harrowing ordeal in the water, Grissom is about to be examined by Doctors Strong (front) and Laning.

Dean Conger, the senior NASA photographer who was on loan from *National Geographic*. He was a wonderful man and a wonderful photographer. We were clowning around in the back of the plane and Dean was taking pictures of Shepard and the rest of us. I then said, "Dean, you just set your camera and you get in there next to Shepard." Now that picture I took of Dean and Shepard in the plane later appeared as an ad for *National Geographic*. I later kidded Conger about not giving me credit for that picture.

Was Shepard very talkative on the way to Grand Bahama?

Oh, yes. He was elated. We had a very pleasant conversation.

Anyway, when we got there I turned him over to the NASA people along with the tapes and specimens. I had packed the urine and blood in ice.

What kind of facility did NASA have at Grand Bahama?

Just a few temporary buildings. We arrived there just about dark and I didn't see much. There was a big hangar and an exam room and the NASA doctors were going to do another physical and more debriefing.

Then came Grissom's flight.

Yes. That was July 21, 1961. The same thing happened with Grissom's flight—the same preparations and all that. But as you know, he lost his capsule.

By this second flight, they had already developed another way of communicating with the Cape if there was a medical problem and they didn't use your medical code any more?

That's right. They used the standard medical nomenclature system of making a diagnosis.

By this time, you had met the astronauts?

No. They still didn't know us, but we were uniformed then.

Was there anything unique about the Grissom flight except for the loss of the capsule?

No.

Were you close enough to see the splashdown?

We saw the parachute. It may have been only 2 miles away.

When did you realize there was a problem?

I was on the bridge and could hear conversation between the helicopter pilots and the bridge. And there was a delay in picking up the astronaut. Grissom had gotten out of his capsule and was floating. He told us later that he was concerned that they might be more intent on picking up that capsule than picking him up. After they had hooked on to the capsule, a red light went on in the helicopter. Ordinarily, you have just a few minutes to fly once that red light goes on. So the pilot decided he had to let go of the capsule. Grissom was in the water and, even though there were two other helicopters as backup, they couldn't get in that close to pick him up until the original helicopter had left. Once the original helicopter let go of the capsule, it sank immediately and that helo came back to the ship. In the meantime, the second helicopter

picked up Grissom and brought him aboard.

Why did Grissom leave the capsule to begin with?

The procedure was to hook up to the top of the space capsule and pull it slightly out of the water. Then the hatch was to be blown. The astronaut would then climb out, attach himself to another cable, and be hoisted aboard the helicopter and returned to the carrier. The capsule would then be recovered and hoisted aboard the carrier. With Shepard everything went perfectly.

Grissom is accused of having prematurely blown the hatch before they were hooked on so water started coming in. He then decided to leave. He denied that and they have done multiple studies and have found that explosive bolts have never blown prematurely. So no one will ever know what really happened. He may have inadvertently pushed that button.

Then when he was in the water, he noticed water entering his suit. There was also concern that since these were tropical waters and his silvery suit was bright and shiny, sharks might be attracted.

What do you recall about him being brought aboard?

Grissom didn't say anything but he was obviously agitated. You could tell by his expression. We took him down to the captain's cabin. But it wasn't long before he calmed down. And then the call from the President came. For this flight they had hooked a telephone line to where we were examining him. We learned a lesson from the first time with Shepard. And he talked to the President.

After we completed his physical, he had time for breakfast and took a little nap. Meanwhile, I was busy getting packed up and putting the specimens in ice. I then went on the plane with him to Grand Bahama Island where we turned him over to the NASA people.

Astronaut John Glenn aboard the carrier USS *Randolph* records recollections of his historic three-orbit mission aboard *Friendship 7.*

When we got to Grand Bahama, Shepard was there to greet him. I followed him in to where he was to meet everyone else and he turned around and said goodbye to me and the rest of the team and thanked us.

Please tell me about John Glenn's [LCOL John H. Glenn, Jr., USMC] flight.

That flight actually occurred on February 20, 1962, even though it had been scheduled several times before. If you recall, Glenn's flight was three orbits. Our ship, the USS *Randolph*, was the prime recovery ship, but Glenn was first picked up by the destroyer *Noa*. After the *Noa* rendezvoused close enough to us, one of our helicopters picked Glenn up and brought him to the *Randolph*.

How far was the *Noa* from you?

Well, it took a couple of hours to rendezvous so it must have been some distance away.

The accuracy was a bit off on that landing.

There was some problem up there and Glenn had to manually fire the retro-rockets for reentry.

That's right. He got an indicator light that his heat shield was loose.

Right. Apparently he slightly undershot the landing.

Did you do another physical when Glenn arrived?

We didn't do another physical because Dr. [Robert] Mulin had already done one. Everybody then wanted our team to go to Grand Turk Island with Glenn but I said no. Dr. Mulin and his team should go. My team was very unhappy I made that decision but I felt it was right for Dr. Mulin's team to go. So I didn't leave the *Randolph*. I went back to port with the ship and ultimately back to my duty station.

Was this the last Mercury flight you were involved with?

No. I was on all the others but not on the prime recovery ship. For the first three missions—the first two suborbital flights and the first orbital flight—the NASA people wanted the same personnel involved. However, after that, the people involved in the recovery system said that all these other teams on the other ships wouldn't want to continue participating if they never had a chance to be on the primary recovery ship. That seemed reasonable. So we began rotating. On one of the other flights I was on a ship near the Azores. I also went to the Pacific for the last Mercury flight.—JKH

SMART Readiness

Gary E. Horne, Sc.D.
LT Thomas W. Dowty, MSC, USN

The military is moving toward managed care options in reforming the military health care system with the implementation of Tricare. At the same time, military decisionmakers emphasize that maintaining readiness is the number one goal of the military medical community. But, what is medical readiness? And what are the readiness performance indicators that will inform the decisionmakers? Decisionmakers who in turn want answers to the question: how can we improve medical readiness *under* the new Tricare system?

Medical Readiness Framework

What is medical readiness? A logical place to begin answering this question is the official definition approved by DOD in 1993. *Medical readiness encompasses the ability to mobilize, deploy, and sustain field medical services and support for any operation requiring military services; to maintain and project the continuum of health care resources required to provide for the health of the force; and to operate in conjunction with beneficiary health care.*

But medical readiness means different things to different people and the definition above is general enough to allow room for a great deal of interpretation. We found that how the definition above translates into details differs greatly depending on the perspective of the person describing the details. In other words, there were as many specific definitions of medical readiness as there were people we talked with. Here we suggest a framework for medical readiness that is compatible with the official definition but still captures the richness and complexity of medical readiness.(*1*)

We began to develop this framework by getting as many perspectives of medical readiness as possible. The first pattern we noticed when discussing the topic with those within the military medical community. For the most part, people talked strictly about one of *two basic sides of medical readiness.* One side was oriented toward the health of the individual, the other toward those providing the care. We call the first orientation *health readiness* and the second *care readiness.*

In relating these two orientations to the phases of overall military operations, our framework includes the understanding that health readiness is part of the preparation phase because the health of all personnel is part of preparing for future military operations. Correspondingly, the deployment of medical personnel and equipment are part of the overall deployment process, and medical support is provided during the overall execution of operations. Thus, care readiness is part of overall readiness for the deployment phase and execution phase of military operations.

Health readiness involves maintaining the health of all types of military personnel. Measures of effectiveness on this side must in some way quantify the ability to deliver a healthy force, a force prepared for war. (It should be noted that we are talking about the health of servicemembers only—not dependents or retirees.)

Care readiness involves the readiness of the caregivers themselves as well as all medical support personnel and equipment involved in providing care during military operations. Measures of effectiveness on this side must in some way quantify the ability to deliver supportive care during military operations, a medical force prepared for war.

The health readiness side can be viewed at least three different ways. We name these perspectives according to the primary group of people from which each perspective came. These perspectives come from people we label as:

- practitioners,
- field commanders, and
- leaders.

In the same manner, the care readiness side can be viewed at least seven different ways. Here the perspectives come from people we label as:

- historians,
- mission planners,
- strategic planners,
- trainers,
- individual services,
- mobilization planners, and
- operators.

We should note here that many individuals we spoke with had a vast amount of experience, and could pro-

vide information from multiple perspectives.

Health readiness and care readiness are clearly distinct. But within each side there are many threads which run through multiple perspectives. For example, the topic of trauma surgeons is a thread which runs through many perspectives on the care readiness side. Trainers are concerned about the lack of opportunities within the military health care system to perform trauma surgery in preparation for war, operators are interested in the numbers and capabilities of trauma surgeons at various sites during operations, and mobilizers want to identify both reserve and active duty physicians with recent experience in trauma surgery.

Goal Setting

The people with each perspective establish goals or objectives to achieve. An appropriate format to use in goal setting is the SMART format. SMART goals identify a *specific* action to accomplish, set *measurable* targets, assign *accountability* to an individual or group, are *realistically* achievable, and establish *time-phased* constraints on when the overall goal must be achieved.(*2*)

Setting goals in a SMART format makes goals measurable. When goals are measurable then each perspective group can determine how successful the organization is in achieving its goals. Knowing how successful one is in achieving a goal, enables better development of the next generation of goals to be set, and ultimately leads the organization to success.

Goal accomplishment is measured via performance indicators. The performance indicator for a goal is simply the amount of the target that has been achieved. Performance indicators are frequently displayed in terms of percentages. If the indicator shows 50 percent completion of a goal, everyone involved can understand the implications. Thus performance indicators bring goal measurement to a common level understanding. We now present some SMART readiness goals from each of the perspectives in our medical readiness framework and suggest possible performance indicators for each.

Goals and Indicators by Perspective

Health Readiness Goals*

The practitioner's health readiness goal is to have servicemembers free of medical problems. A SMART goal could be: practitioners will reduce the number of inpatient dispositions and outpatient visits by 25 percent in 2 years. To measure this goal's achievement, the performance indicator would be the percent of reduction in inpatient dispositions and outpatient visits. A more positive approach could be to set a goal of increasing wellness. The performance indicator for such a goal would be the percent of increase in satisfactory wellness exams.

The field commander's health readiness goal is to have deployable personnel. This broad goal could be defined as several SMART goals. They could be: military treatment facility (MTF) commanders will increase the number of personnel assigned to readiness platforms to 95 percent in 2 years. Another: MTF commanders will increase the number of assigned personnel screened for medical and administrative requirements to 90 percent in 2 years. To measure the first goal's achievement, the performance indicator would be the percent of total readiness positions with assignments. To measure the second goal's achievement, the performance indicator would be the percent of assigned personnel with completed medical and administrative screenings.

The leader's health readiness goal is to keep the military work force on the job. A SMART goal would be to decrease the number of limited duty personnel by 75 percent in 3 years. To measure this goal's achievement, the performance indicator would be the percent of decrease in limited duty personnel.

Care Readiness Goals

The *historian*'s objective is to learn from history. This translates into care readiness goals if we look at some of the specifics—for example, the prevalence of DNBI and the associated objective of providing the best possible preventive medicine. Indicators in this case would include measures of preventive medical capability such as water purification capability. Numerous SMART goals could be developed to satisfy the historian's perspective.

The *mission planner*'s care readiness goal is to be ready to provide the kind of care needed depending on the particular mission at hand. Because every scenario is different, this objective is hard to pin down—it is impossible to be ready for anything, anywhere, anytime. But we can use case mix and patient mix to indicate what medical personnel are practicing, relate that to the type and place of missions anticipated, and as a result know what additional experience might still be useful in various situations.

A SMART goal for the mission planner's perspective could be: Navy medicine will increase the number of providers with experience in wartime level case mix medical treatment. The exact amount of increase and timeframe is debatable, but clearly

*These goals are presented to show how a SMART goal would appear. The specific targets and timeframes are only provided as examples.

the mission planners want providers who have wartime caliber experience.

The *strategic planner*'s care readiness goal is to make improvements within each of the functional areas supporting care. The *Medical Readiness Strategic Plan 1995-2001* contains action plans supporting nine functional areas.(*3*) The data required to indicate performance varies according to the area—here we just mention an example in one of the nine areas, evacuation. A SMART goal could be: planners will decrease the time for evacuation of wounded troops by 30 percent. To measure this goals achievement, the performance indicator would be the percent of decrease in the time for evacuation from injury to definitive care.(*4*)

The *trainer*'s care readiness goal is to provide the appropriate training to all medical personnel. This means providing both the right amount and the right kind of training. The amount of time spent on readiness training is a starting point and certainly a useful overall indicator for this goal. But to measure progress toward this goal properly, a detailed look at what kind of training medical personnel need at all levels is required to accompany information on the number of people getting the training and the time they spend.

The care readiness goal of the *individual services* is to ensure preparedness for those aspects of readiness that are unique to each particular service. The first step toward measuring progress toward this goal would be to carefully outline these aspects for all services. The next step would be to determine for each aspect what readiness measures from the other perspectives might apply.

The *mobilization planner*'s care readiness goal is to ensure that personnel and equipment are available to provide proper care both at the contingency site as well as back home. Thus, indicators of readiness fall into the two areas of call-up and backfill and involve measures of both active duty and reserve personnel. A SMART goal could be: planners will decrease care personnel and equipment requirement shortages by 90 percent in 6 months. To measure this goal's accomplishment, the performance indicator would be the percent of requirement shortages decreased.

The most realistic goals and indicators are measures of the manning and equipping of units as well as the backfill at MTFs during actual operations. But realistic call-ups and backfill can also be exercised prior to major medical exercise play such as that planned for the upcoming CJTFEX 96-2.

The *operator*'s care readiness goal is to provide care quickly and of sufficient quality to save lives while allowing the fighting forces to focus on their job.(*5*) This may mean bringing the proper care to casualties or taking the casualties to the proper care. In any case, the operator wants victory in battle at the least possible cost in casualties. In an actual operation, or even an exercise, victory and number/severity of casualties are easily measured and indicate performance toward the operator's goal. Of course any one operation or exercise produces one set of data. Thus, assumptions and extrapolations must be made to determine if changing some variable (say the number of corpsmen with each unit) would change the number of casualties without changing the outcome of battle.

Moving into the Future

The information from many perspectives indicates that Tricare, as the new program of peacetime health care, may have positive impact on medical readiness, especially health readiness where improvements in the system may mean healthier servicemembers without increasing overall costs.

In general, the major pull between Tricare and readiness is with the care readiness side. Obvious avenues to reduce costs are to either reduce the Tricare outlay or the care readiness outlay or both. Another way would be to increase the intersection of Tricare activities and care readiness activities, if possible. Unfortunately, if the intersection is not increased and the total resource outlay remains the same, then an increase in one will result in a decrease in the other. Herein lies the fundamental tension between the two.

Both tensions and synergies between medical readiness and peacetime health care certainly existed before Tricare. And the goals and performance indicators we discuss here are just a starting point in sorting out the issues. But, by better understanding medical readiness, and by developing SMART readiness goals and performance indicators, we can begin to better inform the leaders who must make the tough decisions that are needed as we move to the future.

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Submarine Appendicitis Revisited*

Godfrey J. Orbeck

I shipped into the U.S. Navy on a 4-year cruise in April 1938. In 1939 I was stationed at U.S. Naval Hospital Great Lakes (IL). The command had started a course of instruction on medical topics on a once-a-week basis; all off-watch enlisted personnel under pharmacist's mate second class attended. The medical officers rotated as instructors. One afternoon Dr. Moore (LCDR French Moore, MC) taught about abdominal emergencies. He gave a very thorough treatment of the subject, especially appendicitis. I can still hear him saying: "Nothing by mouth—Nothing! Nothing!" I benefited greatly from this instruction and it came to be really helpful during USS *Paddle*'s third war patrol.

I made pharmacist's mate first class and became eligible for duty independent of a medical officer in mid-1942. Several shipmates at USN Mobile Hospital No. 1, Guantanamo Bay were applying for duty in submarines. I did likewise.

I reported to the Submarine Base, New London, CT, for instruction and further assignment to duty in submarines in September 1942. Applicants for submarine duty were flocking into the submarine base from ships and stations wherever the U.S. Navy maintained a presence.

I was assigned to the precommissioning and fitting out detail to USS *Paddle* (SS-263) and duty on board following her commissioning.

While submarines were under construction, their crews got acquainted, attended instructional lectures or schools, or did departmental work.

Pharmacist's mates screened incoming health records, scheduled X-rays and shots, and arranged appointments for those requiring medical or dental attention. Pharmacist's mates often got together to discuss matters of mutual concern such as where to stow sun lamps, and to assign watches and duties other than medical. Of course, we also had many discussions over proper procedures for different illnesses and injuries. Acute appendicitis was a favorite topic.

Since the start of the war, two submarines, USS *Seadragon* and USS *Silversides* had a member of their crews develop acute appendicitis while on patrol in enemy waters. The pharmacist's mate on these submarines performed an appendectomy with the help of selected assistants from the crew. Recovery was uneventful in these two cases.

Around early 1943, as it was related to me, the Surgeon General called the Submarine Force Medical Officer to Washington, DC, for a conference. When he got there, the instructions were succinct: "Stop those pharmacist's mates from doing appendectomies on submarines." I was also told that COMSUBPAC sent out a directive stating that no appendectomy be done on any submarine by independent duty pharmacist's mates.

In the meantime, my training regarding submarines continued. Accordingly, I attended Sound School and had instruction on operating radar. Moreover, submarines carry no passengers; all hands were watch-standers. I also stood lookout, helm, messenger, and bow and stern plane watches.

Paddle was launched in the last week of 1942 and she was commis-

*See "W.B. Lipes: One Merchant Ship, One Oil Tanker, and One Successful Appendectomy," January-February 1987:20-23.

Photos courtesy of Godfrey J. Orbeck

VADM Charles A. Lockwood, Jr., presents Navy Commendation Ribbon to PhM1c Godfrey J. Orbeck for his successful treatment of a shipmate for acute appendicitis.

sioned on 29 March 1943. After some weeks of operational training, *Paddle* departed New London, enroute to Pearl Harbor via the Panama Canal.

Paddle made two war patrols out of Pearl Harbor. Both were successful and merited the award of the Submarine Combat Insignia to the crew. *Paddle* then returned to Mare Island Naval Shipyard for replacement of her undependable HOR diesel engines.

Paddle departed Pearl Harbor on 19 March 1944 on her third war patrol. Her assigned search area was in the Molucca, Banda, and Ceram Seas. We had received on board for duty a young man in Pearl, very new to submarines and with no submarine school, named RT2 Jack Withrow. Shortly after we entered our patrol area, he came to me with generalized abdominal pain.

My notes of Jack Withrow's health record follows:*

"4-7-44 Diagnosis: Appendicitis Acute #304. Patient was first examined at 1500 this date. He complains of nausea and vomiting with severe generalized pain in the abdomen of about six hours duration. The pain preceded the nausea and vomiting by several hours. He had been constipated.

Abdominal examination revealed tenderness, particularly in the lower right quadrant. The patient's temperature is 99.8 F, the pulse 96, and respiration 20. He was admitted to the sicklist as a strict bed patient, was given two drams of camphorated tincture of opium immediately, and nothing otherwise by mouth. An ice bag was applied to the abdomen. Reexamination was made every 4 hours to note the progress of symptoms.

4-18-44 By 0800 a steady cramplike pain had localized in the lower right quadrant of the abdomen. Rebound tenderness was present and there was rigidity of the abdominal muscles in the affected area. Temperature was 100.2 F, pulse 100, and respiration 20."

As I remember, I consulted with the executive officer, Mr. Baer (at present: VADM Donald Baer (Ret.)), about the condition of Jack Withrow. I asked, but did not recommend, the possibility of an air evac by PBY. Mr. Baer answered that we were not supposed to break radio silence, that it would require several days of steaming to reach a rendezvous point where a PBY could approach without being shot down, and that we were expecting Japanese shipping through our area. I suggested that it might be wise to review the procedures for a burial at sea in case of need. Mr. Baer replied, "Is it that bad?"

I answered, "Not yet, but it might come to that."

Mr. Baer said, "Do the best you can." I agreed with his assessment of the situation, but remained somewhat apprehensive about what might develop during the next day or two.

My notes continue: "Meanwhile, for the next two days, morphine tartrate was given freely for relief of pain and to control intestinal peristalsis. Sulfathiazole and sodium bicarbonate one grain was given every four hours for a total of four grams daily. The patient was permitted to moisten his mouth with water when necessary, otherwise nothing was taken by mouth except the medication noted above. The fluid level of the body was maintained by intravenous injection of sterile 5% dextrose in normal saline. Retention enemas of the same solution. The ice bag to the abdomen was refilled every four hours. Intake and output chart was kept with the purpose of maintaining output at about 1000 cc daily.

"The temperature, pulse, and respiration at its highest was 103.4 F, 132, and 22, respectively. He was continued as a strict bed patient with routine nursing care."

I continued to stand watches throughout this period. My section had the 4 to 8 steaming watch on the lookout-bow planes circuit. Part of the watch I rotated to being messenger in the Control Room. During this time I was able to go aft to see my patient.

I was not able to sleep very well during Withrow's illness. When I crawled into my bunk to sleep, my mind would begin to wonder how Jack Withrow was doing. Then I would get up and go aft to check him out. The Chief of the Boat suggested that I go off watch list, but that was not a good idea.

*The following material was taken from a copy of correspondence from the Squadron Medical Officer, CDR E.T. Knowles, MC, to his CO, and based on notes taken by Chief Pharmacist's Mate Orbeck aboard USS *Paddle* (SS-263) dated 29 May 1944.

During this time *Paddle* tracked and made a torpedo attack on a convoy. The skipper (CAPT B.H. Nowell (Ret.), now deceased) sank three ships. *Paddle* was rigged for depth charge attack and rigged for silent running. Under this condition, all compartments are totally shut off from each other. Air conditioning, ventilation blowers and bulkhead flappers and watertight doors are secured. No air is circulated—None! In the tropics where sea water temperature runs about 80 degrees F or a little higher, the air in the submarine rapidly heated up and became unbearable. Of course, there is no place to go.

I remember standing over Jack Withrow's bunk, wondering if there was anything that I should be doing that I had not yet done when Mr. Baer came around the corner and said, "Doc, I need some ice. The Captain needs something to drink, and I need ice for it."

"Yes Sir, the ice is in those two little trays in the freezer in the Crews' Mess."

Mr. Baer replied, "Yes, I know, but the cooks won't release any of it. They have a sign posted on the freezer that says `Medical Use Only.' They say it is all for your patient."

"Mr. Baer, you better have some ice for the Captain. We are depending on him to get us out of here."

Mr. Baer got the ice cubes; the Captain got us out from under the depth charges. But I was still worried about my patient's condition. The notes continue:

"4-10-44 Because of a recurrence of nausea and vomiting, the first attack of this nature in 24 hours, sulfathiazole is believed responsible; it was discontinued. Rigidity of the abdominal muscles is no longer present; the other symptoms persist, but to a lesser degree than before.

"4-12-44 The patient has pain and discomfort of the abdomen due to gas. The ice bag was replaced by a hot water bottle, and a rectal tube was also used for relief from gas.

"There is marked tenderness upon pressure in the lower right quadrant. The patient's temperature is 99.8 F, pulse 96, respiration 20. He is a strict bed patient on liquid diet with forcing of fluids. Routine nursing care.

"4-14-44 It is believed by the writer that some time on the second or third day of treatment, the appendix ruptured resulting in a slow leak into a preformed abscess. It is impossible to state the exact time of rupture due to slowly subsiding symptoms. A bulky mass can be felt in the affected area when the bladder is full and distended and upon exerting pressure upon the affected part.

"The patient is put on liquid and semi-soft diet with forcing of fluids and routine nursing care.

"4-16-44 The patient had been allowed up for meals, but due to recurrence of symptoms—this was discontinued. (Stepping through the watertight doors in order to attend meals at crews' mess aggravated his abdomen so much that a volunteer was found to deliver his meals. Richard Wilson, TM2, diligently and faithfully delivered Jack Withrow's meals until we entered port.)

The patient's temperature rose several degrees with proportionate increase in pulse rate. The abdominal

Left to right: **Godfrey Orbeck, Agnes Orbeck, Pat Withrow, Jack Withrow.**

mass increased in size until there was a noticeable bulge under the skin and muscle and it was increasingly tender.

"4-18-44 The patient is allowed to go to the head. The bulky mass in the abdomen has subsided somewhat in size and sensitivity. TPR are normal.

"4-20-44 The bulky mass in the abdomen continues to subside. TPR are normal. The patient is on a regular diet with one and a half ounces of mineral oil daily. He is to continue as a bed patient with head privileges and on the present regimen until this vessel reaches port.

"4-22-44 No change in patient's condition.

"4-24-44 The patient's condition remains unchanged."

On 12 May 1944, *Paddle* entered port at Freemantle, Western Australia. Dr. Knowles (CDR E.T. Knowles, MC), our squadron medical officer, came aboard with the other dignitaries to welcome us to temporary home port in Australia. Dr. Knowles was a most welcome sight. I have never been so happy to see anyone in my life. Jack Withrow went to sick bay aboard *Griffin* and I went about my normal entering port duties.

Dr. Knowles treatment of Withrow is detailed as follows: "Medical History on: Withrow, J.W., RT2c Diagnosis: Appendicitis, Acute; Upon admission to the Sick Bay, the patient appeared somewhat pale and weak and was about fifteen pounds below his weight preceding this illness. Examination of the patient's abdomen showed a moderately sized tender mass just lateral to the bladder, and extending upward from the right side of the pelvis into the abdomen just above Poupart's Ligament. It was fairly soft and ill-defined in outline.

"The patient was put to bed under observation and was given a high-caloric and high-vitamin diet and thiamin chloride 5 mg daily.

"Upon the fourth day the patient was operated under spinal anesthesia. A gridiron incision was made over the mass and upon opening the peritoneum a mass consisting of moderately inflamed gut covered with fibrin was noted. Upon gentle separation of the mass with the fingers a cleavage was made into the center of this area between the coils which soon entered into the center of a pocket extending down into the pelvis and toward the bladder for about four inches. From the bottom of this pocket two fecoliths were removed of about the size of an olive pit and a cherrystone respectively. There was only a small amount of odorless pus in the abscess but the distal end of the indurated and inflamed appendix about three inches long was firmly adhered to the adjacent bowel. This was dissected away from the gut. The proximal end, about one inch in length, and open at the end, appeared only slightly inflamed, and it was clamped, ligated and excised. Five grams of sterile sulfanilamide were then put in and around the affected area; a rubber drain was inserted, and the wound closed.

"The patient stood the operation well, he was given about 400cc of whole blood by citrate blood transfusion method. He was put on 4 grams of sulfadiazine and sodium bicarbonate daily and he had intravenous glucose and saline the first two days. His temperature rose to 101.4 on the first post-operative day and he had moderate hematura on the first two occasions. There was a moderate drainage of bloody serous fluid during this time and the rubber drain was removed after 72 hours. Since then he has progressively improved and the sutures were removed on the eighth post-operative day. Smears from the abscess area showed gram positive and negative staphylococcal on culture.

"He is on a high-caloric and high-vitamin diet. He has had no fever except in the first and second post-operative day, and he is allowed up to go to the head. Patient is gaining weight and has no complaints.

"It is apparent from the foregoing history and operative findings that the patient had his infection well under control and that following rupture, the abscess was undergoing resolution and absorption.

"The case here outlined presents all the features of acute appendicitis from incipiency to climax with rupture and abscess formation and gradual resolution and recovery. That non-operative treatment does not imply doing nothing is here illustrated, but in addition that excellent judgment and estimate of the situation, and meticulous care over a long period of time is required.

"Such a fortunate recovery of this patient was due in great part to the strict attention given the patient by the Chief Pharmacist's Mate and to his meticulous care and most commendable judgment in the management of this case."

Upon recovery Jack Withrow was assigned to USS *Lapon* (SS-260) for duty. I saw him again, hale and hearty, during the war when *Lapon* and *Paddle* stopped at Exmouth Gulf, Western Australia, to top off fuel tanks on their way northward to enemy-controlled waters.

After the war we met by accident at a national convention of U.S. submariners of World War II in Seattle, WA. We have been corresponding since that time. ❑

Mr. Orbeck, formerly a chief pharmacist's mate during World War II, resides in Minneapolis, MN.

The Briefcase

RADM Hubert J. VanPeenen, MC, USN (Ret.)

My work combines the two professions of naval officer and physician. I was on the island of Guam when it fell to the Japanese 10 Dec 1941. Until 10 Sept 1945, military personnel of this island were "guests" of the Emperor of Japan.

Before our forced departure from Guam I was allowed to visit the house from which my family had been evacuated 2 months before. This privilege was given to secure clothing and I was accompanied by a Japanese guard with a loaded rifle. Since the doors of the house were locked, it was necessary to effect entrance through a window. This I did and the guard handed me his rifle to hold while he grunted his short body over the sill. The situation was ludicrous but suggested no mock heroics on my part as he was the possessor of the rifle heretofore trained on my back. There were 3,000 Japanese in possession of the island now and our own 350 fighting men were incarcerated.

Once inside the house I concentrated on what clothing I should take. We were allowed little and there was little choice. Guam was tropical and our clothing was of that nature. The warmest would be insufficient for the cold winters of Japan. Obviously, I should take nothing of a sentimental nature but I did. I took a briefcase given to me by my wife when I graduated from medical school. The briefcase was to become my dearest possession.

The first articles to find their way into that receptacle were filched drugs and small instruments. In filching I could depend upon the intuitive and silent cooperation of that ablest of corpsmen, Keck. His particular education and the personality which resulted from it was especially advantageous in dealing with the Japanese. Keck had been raised in Oklahoma where his father kept a general store for Indian trade. Keck senior was known for his fairness and fearlessness and his sons were brought up on a sturdy pattern, less given to talking than to listening and observing, quick to measure an adversary. It was well that we laid in this small supply of drugs promptly. Soon the Japanese sealed up our storerooms with strips of rice paper which bore the warning in Japanese characters that tampering would be punished by death. And, as usual, the presence of an armed sentry emphasized a Japanese statement.

We left Guam 10 Jan 1942 in the fetid hold of the *Argentina Maru* and arrived at Zentsuji Prisoner of War Camp, Shikoku, Japan, 5 days later. The early days at Zentsuji constituted a period of adjustment getting used to hunger, cold, boredom, and a certain type of daily misery. We did not believe that our confinement could extend to the 3 years and 9 months that it did. Therefore, we were still optimistic and brave enough to exchange verbal snipes with the guards.

I was not the only man to become strangely attached to one small material object. One officer found a rusty

BUMED Archives

RADM H.J. VanPeenen, MC

phonograph needle on our compound and spent hours cleaning and sharpening it although we had no record player. Some months later when the American Embassy left Tokyo a phonograph arrived, a gift of a departing official. A tin can was a wonderful thing. Those who owned such an item guarded it jealously. It could be used for storage, as a receptacle for carrying water, as a utensil for cooking.

A cardboard carton produced almost any article needed from chessboards to shoe soles. We were always scavenging for small treasures and in a land of no waste at all pickings were unbelievably lean.

After 9 months the first censored letters arrived from home. Mine—vivid accounts from my wife and amusing scrawls of four children, ages 5 to 10—were preserved among the cherished contents of my briefcase.

As the war progressed the briefcase took in grimmer contents. June 15, 1942, brought us 65 Australians captured at Rabaul. The battle of the Java Sea and other allied disasters sent us British and Dutch prisoners, sick and wounded, all shivering as many possessed only the short-sleeved shirts and shorts they wore when captured. On 16 Jan 1943, Americans in very bad condition arrived from the Philippines. Troubles were besetting our own oldtimers. Malnutrition and dysentery were already beginning to pave the way for disease and death. In a rough-lined child's copy book I kept case histories, wills, death records, as well as accounts of our altercations with the guards in our efforts to secure better care for the sick and wounded. This book was kept in my briefcase, now broken and shabby and reflecting the universal POW look.

Records of a less grim nature found their way into my leather archives. I received Christmas cards and birthday cards made from ruled paper and box tabs and illustrated pencil, pen, or crayon stub. From the formal British:

Wishing you a Merry Xmas
and
Liberty in the New Year
Officers of the Royal Air Force

(and a neat and perfect inked-in emblem of that unit). From a less formal compatriot:

Have a smoke on me/God knows
you rate one!
A Chronic Belly-Acher.

I received written invitations to "dine" with a certain group or unit. Often a highly illustrated and ironical menu accompanied the invitation. On such occasions a cigarette had been saved for me or all had contributed a little from their own rice rations. A menu such as the following:

Potage Zentsuji
Pate a la Croix Rouge
Ris Bouille
Sauce de Fois Gras
Gateau Grape Nut

could be translated into something like this:

Watery Rice Soup
Scrap of Liver Sausage (relic of Red Cross)
Teaspoon of Boiled Rice
Above Mentioned Scrap Liver (repeated from menu purposes only)
Nonappearing Pickles
Grape Nut Cookies (made without flour, sugar, shortening)

I received humorous drawings of our scraggly "Sick Call," and a portrait of my scarecrow self-painted by a Dutch scarecrow whose canvas was a silk handkerchief, Poems, touching and humorous, were added to my personal treasures.

The care of the sick became daily more difficult and my briefcase was opened more and more to receive the small keepsakes of the very ill offered apologetically: "Just in case I don't make it, Doctor." Keck, as an enlisted man, was able to bring in extra food secreted in his trouser cuffs and shoes. He had to be careful or he rained rice. There were not enough blankets. Those we had were steeped in filth of patients too weak from dysentery to aspire to cleanliness. We washed the blankets in inadequate buckets of cold water and held them between us before the miserably small charcoal stoves. It was not encouraging to know that our own blankets, wrapped around the sick, were becoming as useless to us as the ones we held. Helpers with the sick were all hands and international, but Keck by training and endurance was of inestimable value. His hands were gentle in caring for patients, his manner reassuringly jaunty. He was adept at drawing the wrath of

the guards to himself and away from sick men less able to cope with any new form of misery. Furthermore, he had the respect of the guards and if he was not persistently able to wangle small favors for the sick his brashness in supplying them himself was sometimes overlooked by "Club Fist," "Donald Duck," "Droopy Breeches," or others of the guards. The extra bit of food to be doled out to moribund men went into the now bulging briefcase.

In addition to his many other self-imposed duties, Keck had early appointed himself my orderly. He trimmed my beard and hair and did the laundry. As I became thinner and weaker he doubled his solicitous care.

Time continued to pass slowly and the war did not end. Our camp was now so crowded that each man had only a space 6 foot by 22 inches for himself and no few could be comfortable standing or sitting unless the majority were in bed. To conserve strength and to get out of the way of others we were often in bed. Lying in my bunk and gazing at the briefcase on its 22 inches of shelf proportioned to me, I realized that it was a symbol of hope and return. Here were the pencil-scrawled documents to be given to my superiors, the treasures of men no longer living to be delivered to their next of kin, the last little bit of dwindling supplies that might, God willing, return some of the sick to their families, my own family's letters based on future reunion, the telling handmade "souvenirs" of Christmases and birthdays of nearly 4 years spent away from home.

We had lived so long at Zentsuji that we had developed a sense of security born of permanence only. In March 1945 we sensed an uneasiness amongst our captors which took the form of greater irascibility toward us. This particular uneasiness became general when we learned that our headquarters was officially transferred to Hiroshima and we were to be moved there. On 23 June 1945, we left Zentsuji by foot prodded by the bellowing of strange guards. We were loaded down with personal gear, none of which would have escaped burning or burying in civilized society, but it was all we had and so was valuable to us. We were piled into small trams where there was neither space nor welcome for possessions and some of the latter were discarded. At Okyama we spent an agonizing night in a crowded waiting room during an air raid alarm. We arrived late at night in Fukiui City and from this point began the strangest and wildest of streetcar rides. For 23 miles up and down mountain precipices with drops of hundreds of feet we traveled at top speed. From the chattering of guards we had learned that plans had changed and while some of our guards were to go to Hiroshima the main body of the camp was to be turned off to the mountain seclusion of Roku Rushi.

Photo courtesy Mrs. T.W. Keck

LCDR Truman W. Keck, MSC (Ret.)

At midnight we came to the foot of a mountain. There we were mustered and a 9 kilometer walk straight up the mountain began.

Although I had tossed aside excess impedimenta with the rest I had stubbornly held to my briefcase. The handle had broken and I had sacrificed a ragged shirt to make a sling from which to suspend the case from my shoulder. The heavy weight thumped against my side in a painful ache. As I climbed my foot sometimes struck the abandoned possession of another. Mentally one stooped to retrieve a comrade's lost treasure but physically one did nothing. Fatigue was one factor and caution was another. No man with our experience would risk inciting the now very worked-up and always unpredictable strange guards to deeds of fury. And, how many more steps forward before one's own last possession joined the discards?

Somewhere on this climb I eased the sling cutting into my shoulder, felt the heavy released impact of my briefcase upon my hand and arm and knew I could tolerate its weight no further. I dropped it there on the roadside.

The physical burden was gone—and hope with it. We knew from the erratic behavior of the guards that the tides of war were somehow turning and felt that however they turned the disadvantages of the captured would be multiplied. As physical men none of us was worth saving. Tuberculosis and dangerous heart murmurs were in our ranks. We were fetid with dysentery and skeletal in appearance and, as prisoners of war, we had the contempt of the Japanese. It was even logical to believe that machine gunning in a mountain retreat was the most sensible means of extermination.

The next 3 months did little to lift our spirits except that each morning

found us alive. These months were a nightmare of brutality, mass punishments, constant beatings, lack of supplies such as we had never experienced in the rigor of Zentsuji. Then, miraculously, the war was over.

It came to us as suddenly as I write it here. The close contact of confinement and a mutually suffered hate was gone. The once strong cords that bound us were fragile threads that broke readily and we left each other with relief and the future in our eyes. We were dispersed to hospitals near our homes and when we were physically fit we went home on leave. The joy of this moment is too personal to dwell upon. Less can one explain the rehabilitation of a man long removed from society and how much too quickly the world moves for him.

I had reports and letters to write, messages to deliver, questions to answer, information to give. Where men's lives are concerned memory is a deceptive counselor. My indisputable facts were lying on the mountainside leading to Roku Rushi. My briefcase had been no authentic symbol of hope since I had managed to return alive without it, but its practical contents could still render service to the cause of captured men. And I missed it.

My month of leave was almost up when one morning, still feeling awkward in new suit, whole shoes, and "bare" face I opened my mailbox to find a penny postcard addressed to me. I turned the card over and read the message—as jaunty and laconic as its writer—a message that read to me as lyrically as a poem and merged the separated past and bewildering present into an acceptable continuity:

Dear Doctor . . .
I have your briefcase.
Where will I sent it?
Yours,
Keck

—Reprinted with permission from Dr. H.J. VanPeenen III

Dr. VanPeenen spent 45 months as a POW. Following his liberation the Navy awarded him the Legion of Merit "For exceptionally meritorious conduct . . . while interned as a prisoner-of-war at Zentsuji War Prison Camp on Shikoku Island, Japan, from September 1, 1942 to June 23, 1945 . . . The only doctor permitted by the Japanese to give medical treatment to the prisoners, Commander (then Lieutenant Commander) VanPeenen performed numerous major and minor operations, including several appendectomies under difficult and unsanitary conditions and with limited equipment, with such skill that all operations were completely successful. Although in weakened condition himself from the same callous treatment and starvation diet accorded the rest of the camp, he fought constantly with the Japanese authorities for the welfare of the prisoners. At the risk of his security and quite possibly his life, he held out and hid from the Japanese valuable equipment ordered turned in and stole from them medicine for the use of the prisoners. By his tact, courage and perseverance in dealing with the unsympathetic and extremely difficult Japanese Medical Department, and by his unstinting efforts on behalf of prisoners of all nationalities, (he) inspired the admiration of all who knew him and sustained the morale and health of all prisoners in the camp . . ."

After a distinguished career, Dr. VanPeenen retired from the Navy as a rear admiral in 1963. He died in 1980.

For his heroism in the Zentsuji POW camp, CPhM Truman W. Keck received the Navy Commendation Ribbon. After a 30-year career in the Navy, he retired in 1961 as a lieutenant commander in the Medical Service Corps. He resides in Nottingham, NH.—JKH

Errors in Pap Smear Interpretation:

What Every Provider Should Know

LCDR C.W. Ollayos, MC, USN

The Papanicolaou ("Pap") smear is one of the greatest weapons in the war against cancer. This well-known medical test has helped save thousands of lives since Dr. George Papanicolaou (1883-1962) introduced it in 1943.(*1*) However, failures in Pap smear testing do occur. Several Pap smear screening failures have received wide exposure in the media recently. These incidents provide a good backdrop for discussing the strengths and weaknesses of the Pap smear.

The Pap smear is a test performed on part of the female genital tract called the uterine cervix. This is the lowest portion of the uterus, and it can be seen through the vagina with the aid of a speculum. A spatula or brush is used to remove some cells from the cervix and vagina, and these are spread directly on a glass microscope slide. The cells are then preserved and sent to a laboratory. At the lab, the cells will be stained and then examined under a microscope. Usually the slide is examined by a cytotechnologist. If necessary, the slide will also be reviewed by a pathologist.

The Pap smear can detect several types of infectious agents, including bacteria, viruses, and parasites. The Pap smear will also occasionally detect several types of cancer from the vagina, endometrium, ovary, and fallopian tube. Most importantly, however, the Pap smear is used to screen for cancerous and precancerous lesions of the cervix itself.

Cervical Cancer

As recently as the 1940's, cervical cancer was the leading cause of cancer deaths in women in the United States. However, annual deaths from cervical cancer have been dropping, mostly due to the widespread use of screening Pap smears. In the 1940's, just prior to the introduction of the Pap smear, the incidence of cervical cancer was 30 cases per 100,000 women. Now the incidence is about 10 cases per 100,000 women.(*2*) Still, it is estimated that there will have been about 16,000 new cases and 5,000 deaths from cervical cancer in 1995.(*3*)

Several types of cancer can occur at the cervix. Numerically, however, one type is by far the most significant. This is squamous cell carcinoma. Fortunately, the Pap smear is most able to detect this type of cancer. In the 1950's, approximately 95 percent of cervical cancers were squamous cell carcinomas.(*4*) However, because of early detection and eradication of precursor states, the relative incidence of squamous cell carcinoma has been decreasing. Now only about 70 percent of cervical cancer is squamous cell carcinoma.(*5*)

Because it remains the most significant lesion numerically, the rest of this article will discuss only squamous cell carcinoma and its precursors.

HPV Infection and Squamous Cell Carcinoma

In at least 90 percent of cases, squamous cell carcinoma of the cervix appears to be caused by an infection with human papillomavirus (HPV).(*6*) HPV has many strains, only a few of which have been closely linked to subsequent development of cervical carcinoma. HPV is transmitted sexually.

The prevalence estimate of cervical HPV infection depends on the methods used to detect it and the population studied. When Pap smears alone are used to detect evidence of HPV infection, prevalence estimates range from 1.5 to 37 percent.(*7-11*) When molecular techniques are used, evidence of HPV DNA may be found in up to 14 percent of women with normal Pap smears.(*7*)

HPV infection can cause a variety of squamous cell changes which can be detected on Pap smear. Most often these findings demonstrate the existence of precancerous lesions. These precancerous lesions are not actually malignant, but they do serve notice that the woman has evidence of HPV infection and is therefore at increased risk for squamous cell carcinoma. Occasionally, a woman will have a Pap smear that is already diagnostic for true squamous cell carcinoma of the cervix. Only a small minority of women with HPV infection will actually go on to develop squamous cell carcinoma of the cervix.

Classification of HPV-Related Changes

HPV infection produces a variety of abnormalities which can be detected with the Pap smear. Over the years, several classification systems have been used to categorize these changes. The "Bethesda System," developed in 1988(*12*) and modified in 1991,(*13*) is now the most widely used system. This system groups the precursor lesions of squamous cell carcinoma into two groups. The first tier is called low-grade squamous intraepithelial lesion (LSIL). This category includes the previously used terms of koilocytosis, koilocytic atypia, HPV effect, cervical intraepithelial neoplasia (CIN) 1, and mild dysplasia. The second, more severe tier, is called high-grade squamous intraepithelial lesion (HSIL). This category includes the previously used terms of CIN 2, CIN 3, moderate dysplasia, severe dysplasia, and carcinoma in situ.

Other diagnostic categories exist in the Bethesda System to describe other findings. A separate category exists for true squamous cell carcinoma. Another diagnostic category is "atypical squamous cells of undetermined significance" (ASCUS). This diagnosis is given when findings of an uncertain nature are noted. There are also other categories for infectious, reactive, and glandular changes, but these will not be discussed further in this article.

Errors and the Pap Smear

The strength of the Pap smear is simply that it works most of the time. By any reasonable standard, the Pap smear has been the greatest success in the war against cancer. The reduction of cervical cancer mortality discussed above is due to the widespread use of this test. Unfortunately, the Pap smear seems to have become the subject of unattainable expectations. Both health care providers and the public often feel that Pap smears should be 100 percent reliable. The greatest weakness of the Pap smear is that, even under the best of circumstances, a small percentage of smear interpretations will not reflect what is actually happening in the patient. The rest of this article will discuss what types of errors occur, how often these errors occur, and why these errors occur.

Two types of errors occur in Pap smear interpretation. The first is called a false-positive error. This means the Pap smear is interpreted as abnormal, but the patient is healthy. The second type of error is called a false-negative error. This means the Pap smear is interpreted as normal (or perhaps as having benign reactive changes), but the patient really has ASCUS, LSIL, HSIL, or squamous cell cancer. This latter sort of error is the type that has the most important clinical implications and tends to make headlines in the popular press.

One large study found the major discrepancy rate in Pap smear interpretation to be 5 percent.(*14*) The results were broken out further to reveal a false-positive rate of 5.1 percent and a false-negative rate of 4.2 percent. However, these figures probably represent the best case scenario because the participants were aware they were being tested and may have exercised extraordinary care when reviewing the smears. In more representative studies, the false-negative rate has been reported to be in the range of 9 percent to 40 percent.(*15-21*)

The "positive predictive value" (PPV) and "negative predictive value" (NPV) are statistical derivatives of a test's sensitivity and specificity. In the case of Pap smears, the PPV is an answer to the question, "How many patients with an abnormal Pap smear interpretation really have that disease?" In the case of Pap smears, the NPV is an answer to the question, "How many patients with a normal Pap smear really have a normal cervix?" DiBonito and colleagues found

Pap smears in their institution had a PPV of 80.2 percent and a NPV of 91.3 percent.(*15*) This PPV indicates that 20 percent of women with a Pap smear interpreted as abnormal will actually have no cervical disease. Similarly, this NPV means that nearly 9 percent of patients with a "normal" Pap smear actually have a clinically important disease that was not detected.

McIntyre-Seltman identified several reasons why any single Pap smear might fail to identify a disease process.(*22*) These are:

(1) The lesion might not be shedding cells.

(2) The lesion might not be sampled because it lies in a hard to reach location.

(3) The lesional cells might be overlooked or misinterpreted by the laboratory staff.

(4) The lesional cells might be obscured by poor fixation, blood, or inflammation.

Reasons 1 and 2 are generally grouped and referred to as "sampling error." Reason 3 is generally referred to as "screening error." The literature reports sampling errors are responsible for 25 percent to 91 percent of false-negative interpretations, and screening errors are responsible for 9 percent to 75 percent of false-negative interpretations. (*15, 18, 23-24*)

The Bottom Line

The take-home message is that errors occur in Pap smear screening, even among the best clinicians and the best cytology laboratories. Although most cytology laboratories strive daily to reduce error rates, the innate qualities of the test make perfection impossible. It is also important to emphasize that laboratory staff is not responsible for many Pap smear errors (see "sampling errors," above).

The Pap smear is a good test, but it is not a perfect test. Despite its limitations, the cervical Pap smear remains the best tool available for the detection of squamous cell carcinoma of the cervix and its precursors. Ironically, the way to make the Pap smear a better test is to do more of them. If a patient has three normal Pap smears over a 3-year period, the false-negative rate drops to a very respectable 2 percent.(*22*) Thus, all women should be encouraged to have a Pap smear every year.

Finally, clinical and laboratory staff should freely discuss the limitations of the Pap smear with colleagues and patients. Many laboratories are putting statements on their Pap smear reports presenting some of this information. If the strengths and weaknesses of the Pap smear are understood, it can be used more effectively to detect cervical diseases while the potential for a full cure remains high.

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Medical Implications of War at Sea

I read Dr. Smith's article [Stretching the Limits of Naval Self-Sufficiency: Medical Implications of War at Sea] in the November-December 1995 edition of *Navy Medicine.* It was insightful and quite eye opening. It did fail, completely, however, in one major area. The weak link that he did not address or may have overlooked is the training given to medical people (hospital corpsmen) in the field. These primarily young men are sent out on a float or into the field with their marines with the barest minimum of training.

In their basic medical training they are given no trauma orientation. The training they receive may qualify them for EMT status, but the seriousness of the battlefield will easily overwhelm them.

I have participated in three major conflicts (Beirut '82, Desert Shield/Storm, and Somalia). In all three of these evolutions, serious major life-ending/threatening injuries took place.

In Beirut a young marine stepped on cluster munitions and sustained over 82 separate injuries from shrapnel. He died from his wounds. The medical officer with the marines chose to fly out to the ship with the injured man, leaving his marines on the beach with just corpsmen for medical care. Additionally, and more importantly, three of his buddies were with him at the time and they sustained severe injuries which had to be treated by the Line Company corpsman.

In Desert Shield/Storm I was part of a Medical Battalion, Collecting and Clearing Company. We treated 280 plus casualties (enemy as well as our own) in the 5 days of the "conflict." In March of that year my unit was near an airfield where a Saudi C-130 crashed with 105 people on board. Only five survived the crash and only four left our area alive. Again, the first people on the scene were field corpsmen. Even with the large number of doctors (8-10) on hand in this type of unit, it was impossible for them to treat all the casualties.

During Somalia I was with the 2nd Battalion, 9th Marines. In a 45-day period we saw 752 people. These ranged from common colds to gunshot wounds (a foreign national TV reporter who had his femur shattered by a rifle round) to closed head trauma, to massive injuries from exploding mines. *My personnel took care of the four people who ran over the land mine in the Land Rover.* They also treated a Somali woman who was pregnant and shot in the chest. The marines with us wanted to know why we didn't try and deliver the baby. In the one instance where the French fired on a Somali vehicle there were seven injured. There were two sucking chest wounds, one closed head injury, two bullet wounds to the leg, and two bullet wounds to the arm, with one of them causing a compound FX of the humerus. The FX of the humerus became a drug overdose when one of the French gave the woman (weight approximately 25 kilos) 16 to 20 milligrams of morphine. Every one of these people owe their lives to the corpsmen attached to the unit (our medical officer did not get a chance to look at the seven as we flew them directly from the field to the LPH supporting us).

In Somalia I had 40 corpsmen (including myself). Of these 40 individuals 25 of them were what I consider "pipeline" personnel. They joined the Navy, attended boot camp, then went to Hospital Corps "A" School, then Field Medical School, then my unit. It is an old joke but I literally had more time in the chow line then these

individuals had in the Navy. In a little over 5 months we were engaged in combat operations for real.

In the three conflicts that I have just discussed, lives were saved and good medical care provided simply because senior people such as myself and the medical officers that I have worked with put in the extra time and effort to give the junior corpsmen the necessary education and skills to be able to handle these types of trauma.

In conclusion I feel it is a very slipshod method hoping that the experienced senior enlisted personnel and the doctors (both of which may or may not have seen any trauma during their training) will care enough to train their junior troops to be able to handle combat casualties. It is totally immaterial how well we train our shipboard medical personnel or how advanced the medical equipment available if we cannot keep the wounded alive until they reach the advanced medical care. I feel that, at very least, every corpsman that goes to the Marines or on board ship should be given a course like the Army Special Forces attend (18 Delta Course). Does this reflect a *serious* increase in funding for medical training—*Yes.* Is it justified? Just ask any marine who has been wounded in combat.

Respectfully,
Stephen T. Higgins
HMC(SW/FMF), USN

♦ ♦ ♦

In Memoriam

CAPT **C. Edwina Todd**, NC (Ret.), died 17 Feb 1996 in Glendora, CA. She was buried at Arlington National Cemetery with full military honors.

CAPT Todd, born in Coalinga, CA, on 23 Nov 1911, graduated from the Huntington Memorial Hospital in Pasadena, CA, in 1933. She joined the Navy Nurse Corps in 1936 and was soon assigned to the Cañacao Naval Hospital in the Philippines. In January 1942 she and 10 of her nurse colleagues became prisoners of the Japanese. They remained POWs for nearly 38 months until the U.S. Army liberated them in the daring Los Baños raid on 23 Feb 1945.

After several months of convalescent leave, CAPT Todd joined the staff at Naval Hospital Long Beach, CA. In 1954 she reported aboard the hospital ship USS *Consolation* (AH-15) as chief nurse and then served at Naval Hospital Portsmouth, VA.

Her next job was chief nurse at Naval Hospital St. Albans, NY. While stationed in the New York City area, she attended Teachers College at Columbia University where she earned an MA degree in nursing service administration. She then served as chief of nursing service at Naval Hospital San Diego, CA.

CAPT Todd retired in 1966 at Naval Hospital Portsmouth, VA, after a 30-year career. She held the Army Distinguished Unit Badge, the Army Bronze Star (with a "V" for valor), a gold star in lieu of a second Bronze Star awarded by the Navy, two Presidential Unit Citations, the Asiatic Pacific Campaign Medal with two stars, the Victory Medal, the National Defense Service Medal with two stars, the United Nations Medal, the Philippine Defense Ribbon, the Philippine Presidential Citation, the Philippine Liberation Medal, and the Korean Service Medal with three stars. ❑

BUMED Archives

Edwina Todd (center) with her liberated comrads, Eldene Paige (left) and Dorothy Still

Naval Medical Research and Development Command Highlights

●Patent Issued for Artificial Horizon Warning System

Over 50 percent of tactical aircraft fatalities occur during low-altitude maneuvering, sometimes referred to as controlled flight into terrain. Controlled flight (the pilot literally flies the aircraft into the ground or water) mishaps continue despite sophisticated ground proximity detection devices. A Navy patent was recently issued based on research at the Naval Aerospace Research Laboratory (NAMRL), Pensacola, FL. NAMRL researchers invented an artificial horizon altitude warning system that warns pilots of ground proximity using peripheral visual cues. The warning system includes the projection of an artificial horizon, extending to the limits of the pilot's peripheral vision, superimposed over the actual horizon. Prior to the new system, the minimum time from warning to pilot reaction was approximately 970 milliseconds. With this new system there is no need for eye movement and the reaction time can be reduced to approximately 310 milliseconds. This capacity will significantly decrease pilot reaction time and save lives.

●Biochemical Decompression

Decompression is a dangerous and time-consuming phase of any diving mission. A dive to 190 feet for 40 minutes requires 103 minutes of decompression. On longer dives, decompression can take many hours and possibly be the most hazardous part of the dive. Failure to spend time at an intermediate depth before surfacing can lead to a debilitating illness referred to as decompression sickness (DCS). Treating DCS through recompression requires hours to days, is not always successful in restoring health, and could compromise the mission. Researchers at the Naval Medical Research Institute (NMRI), Bethesda, MD, are focusing on biochemical concepts for diver decompression. The specific aim of the research is to change the process of decompression, from a passive and empirically-modeled approach, to active biochemical reactions. Biochemical decompression is a novel approach to eliminating the inert gas in a diver's body using nontoxic bacterial enzymes in the intestinal tract to chemically eliminate the gas and accelerate decompression without increasing the risk of DCS. The development of this initial work into an FDA-approved product for human-use trials is the next phase of study. Human trials are expected in 5 to 7 years.

●Experimental Treatment for Sepsis

In combat a wounded sailor or marine may survive initial blood loss, only to succumb to multiple organ failure due to septic shock. The duration of a "Golden Period" for stabilization and initial treatment represents a crucial time when vigorous medical support must be administered to save lives. Researchers at the Naval Medical Research Institute, Bethesda, MD, are investigating bacterial translocation from the gut using a model of hemorrhagic shock to study sepsis following hemorrhage. The aim of the research is to understand and control the effects of shock at the cellular level. Bacteriological cultures of livers, spleens, and lymph nodes from mice given selected cytokines had significantly fewer bacterial/gm of tissue than those given saline. Histological examination of intestines revealed restoration of intestinal mucosal integrity following cytokine administration. Further, Doppler flow measurements showed that intestinal ischemia was reversed following oral administration of cytokines. These results suggest that oral administration of selected cytokines may be an important treatment for the prevention of sepsis and septic shock following hemorrhage.

For more information on these and other research efforts contact Doris M. Ryan, Deputy Director, External Relations, at DSN 295-0815, Commercial 301-295-0815, FAX 301-295-4033, or E-mail ryand@mail-gw.nmrdc.nnmc.navy.mil.

Navy Medicine Circa 1913

BUMED Archives

Corpsmen pitch a tent at an unidentified naval hospital.

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